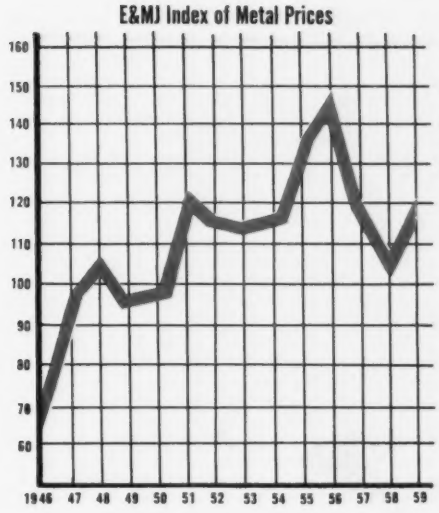
ENGINEERING AND MINING JOURNAL

A McGRAW-HILL PUBLICATION

FEBRUARY 1960

PRICE ONE DOLLAR

FOUNDED 1866



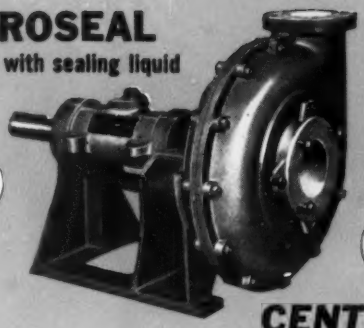
91ST Annual Survey And Outlook

GOLD
SILVER
COPPER
LEAD
ZINC
ALUMINUM
URANIUM
IRON ORE & STEEL
MAGNESIUM
TITANIUM
TIN
MERCURY
LITHIUM
BERYLLIUM
BORON
SEMI-CONDUCTORS
COLUMBIUM-TANTALUM
ZIRCONIUM
ANTIMONY
CADMIUM
BISMUTH
PLATINUM
THORIUM
RARE EARTHS
NICKEL
COBALT
MANGANESE
CHROMIUM
TUNGSTEN
MOLYBDENUM
SULPHUR
PHOSPHATE
ASBESTOS
VERMICULITE
VANADIUM
GYPSUM
BARITE
FLUORSPAR
FELDSPAR
MICA
POTASH

Engineered pumping of abrasives corrosives acids

INTERCHANGEABLE

HYDROSEAL
operates with sealing liquid



Split-Shell SLURRY and SAND Type
2" to 14"

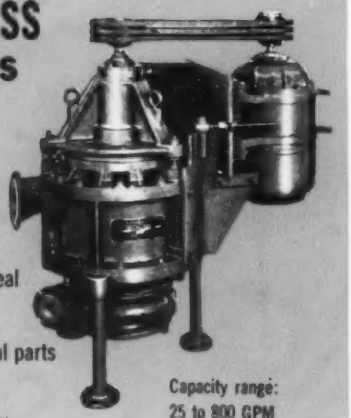
Brochure No. 457

Brochure No. 557

CENTRISEAL
delivers the pulp undiluted

PACKLESS Pumps

No stuffing box
No packing
No mechanical seal
No liquid seal
No exposed metal parts



Capacity range:
25 to 800 GPM

Brochure No. 857

Flex-Check Valves
RUBBER-LINED

For pipe diameters up to 12"
For solids up to ¼"

Brochure No. 957

RUBBER-LINED PUMPS

HYDROSEAL
VERTICAL
sump pump

Brochure No. 757

METAL PUMPS

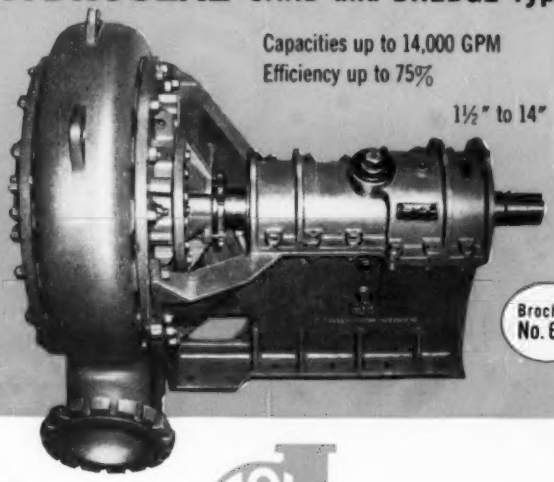
RUBBER-LINED or ALL-METAL
Four sizes: 1½" to 6"
Slurry, Sand & Dredge

Brochure No. 357

To have an easy key to the correct type and size of pump, write us for "Technical Data" Brochure No. 357. For information in the category of your need, use the specified number. In the refinements of application, our engineers can help you.

HYDROSEAL SAND and DREDGE Type

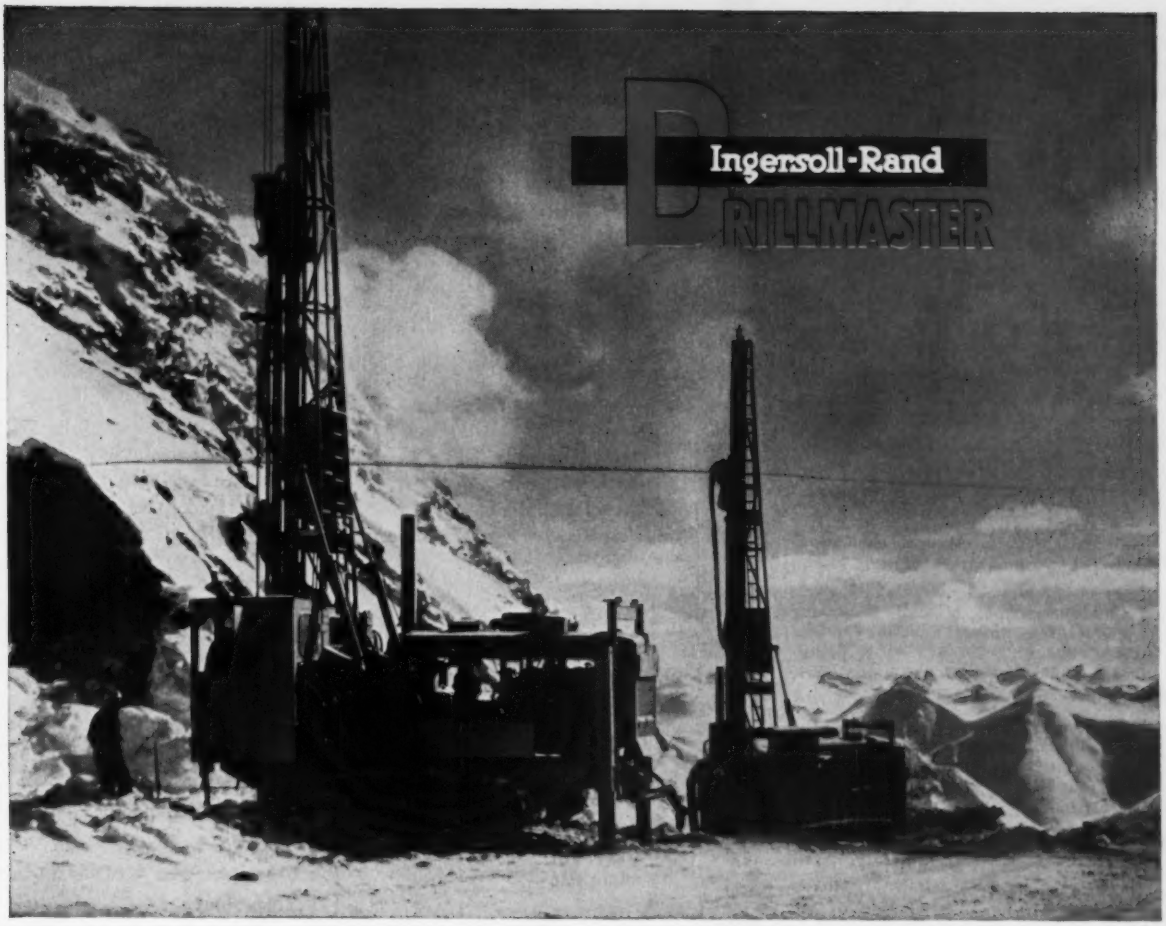
Capacities up to 14,000 GPM
Efficiency up to 75%
1½" to 14"



Brochure No. 657

THE ALLEN-SHERMAN-HOFF PUMP CO.
Dept. B—P.O. Box 635, Paoli, Pa.
Representatives throughout the World

HYDROSEAL and CENTRISEAL
SAND, SLURRY & DREDGE PUMPS
MAXIMIX RUBBER PROTECTED



I-R Drillmasters average 100 ft. per shift, 24 hours a day, in MILE-HIGH ASBESTOS QUARRY

At an elevation of 6200 feet on a spur of McDame Mountain in British Columbia, the Cassiar Asbestos Corp. is mining 2500 tons of ore and removing an additional 3000 to 5000 tons of overburden each day. Here, in sub-zero temperatures, crews work around the clock in three shifts, 7 days a week during the so-called "summer".

To maintain high production during the mining season, two I-R DM-3 Drillmasters with Downhole Drills and 6½" Carset bits are in continuous use, averaging 100 feet per drill shift. Holes are put down 33', spaced 16½' apart with 15' burden, resulting in 14.5 tons of broken rock per foot drilled, using 5x16" Dynamex cartridges, as well as prilled ammonium nitrate and fuel oil.

In this rugged, snow-covered terrain, the excellent traction and maneuverability of the crawler-mounted Drillmaster is a big asset, and its self-contained Ingersoll-Rand Gyro-Flo compressor provides maximum drilling pressure without air line losses from long lengths of piping or hose.

In warm weather or cold, at high altitudes or sea level, a Drillmaster is your best assurance of top drilling efficiency at rock-bottom cost. Ask your Ingersoll-Rand engineer for further information on its features and performance.

Ingersoll-Rand
11 Broadway, New York 4, N.Y. 6A8

A CONSTANT STANDARD OF QUALITY IN EVERYTHING YOU NEED FOR DRILLING ROCK

Mining Calendar

Annual meeting, AIME, New York, Feb. 14-18, 1960

Australian Institute of Mining & Metallurgy, Adelaide Branch Symposium on Hydrometallurgy, "Wet Processing of Minerals and Industrial Products," Feb. 16-19

Governor's Industrial Safety Conference, statewide meeting, San Francisco, Calif., Feb. 16-17

Symposium on Pilot Plants in Metallurgical Research and Development, Jamshedpur, India, February

National Western Mining Conference and Exhibition. Denver Hilton, March 17-19

Fifth International Mineral Processing Congress, Westminster, London. The Secretary, Institution of Mining & Metallurgy, 44 Portland Place, London, W.1, England. April 6-9

Fifth Annual Mining, Minerals and Petroleum Conference, sponsored by Alaska and Southwest Alaska Sections, AIME, and University of Alaska. On the campus at College, Alaska, April 11-13

Southwest Metals & Minerals Conference, AIME, Los Angeles, Calif. April 21-23

Gold and Money Session, 1960 Pacific Northwest Metals & Minerals Conference, AIME, Portland, Ore., April 28-30

International Congress on Research into Ground Control and Rock Mechanics, Paris, France, May 16-20

Wyoming Mining Association, Jackson Lake Lodge, Wyo. June 10-11

XXI International Geological Congress, University of Copenhagen, Denmark. American Geological Institute, 2101 Constitution Avenue, N.W., Washington 25, D.C. Aug. 15-25

Coming Up

On-the-spot—a visit to Surinam, where a major airborne search is being conducted by a young nation in search of development and progress through wise use of its raw material potential.

The latest in performance figures and potential on the Robins Borer, a machine which is attracting the attention of mining men all over the world.

Making the road fit the haulage job—How Monsanto Chemical constructed its own road to take huge payloads. A product of imaginative engineering.

93rd YEAR OF PUBLICATION

ENGINEERING AND MINING JOURNAL

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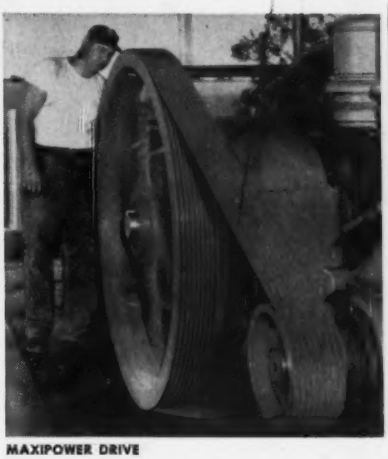
B.F.Goodrich

V belt briefs

TIPS ON THE CARE, MAINTENANCE AND SELECTION OF V BELTS FOR INDUSTRY

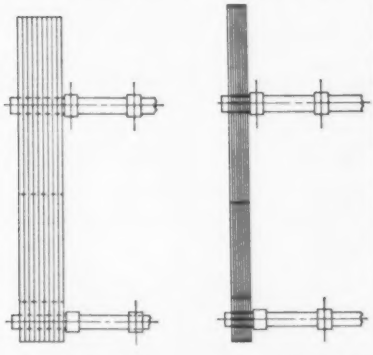
ORDINARY V BELT DRIVE



MAXIPOWER DRIVE

SAVE $402.14 ON V BELT DRIVES—*Costs for* both *sheaves and V belts were cut when B.F. Goodrich Maxipower belts replaced ordinary belts on this drive. Size and weight of sheaves were reduced, smaller and fewer V belts were used*—eight *5V2500 belts replaced* nine *D-240 belts. The result: a $402.14 saving. Costs can be cut as much as 30% by switching to a Maxipower V belt drive.*

How Maxipower V belts reduced bearing load 42%

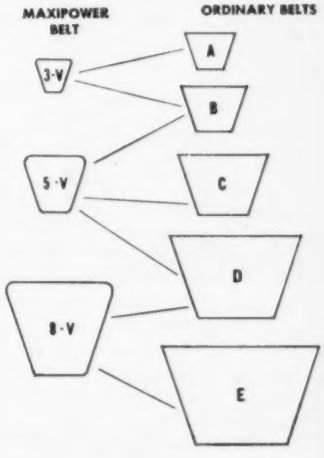


ORDINARY DRIVE — MAXIPOWER DRIVE

In the installation shown above, sheaves for the Maxipower drive are lighter, have a face width of only 5 13/16", compared to a 13¼" width for the sheaves on the ordinary drive. Because there's less weight, less shaft overhang, bearing load for this Maxipower drive is 42% less for the driven shaft shown than the drive replaced. This greatly increases bearing life.

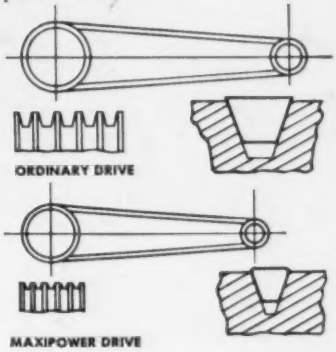
With Maxipower V belts, three cross sections do the work of five

Each cross section of the new B.F. Goodrich Maxipower V belts has been fitted to a particular horsepower range so that only three cross sections are needed instead of the A, B, C, D, and E sections of conventional V belts. The three cross sections are 3V, 5V and 8V.



New BFG Maxipower V belts save space, weight, bearings, dollars

New B.F.Goodrich Maxipower V belts give up to three times the horsepower-carrying capacity in the same amount of space as ordinary belts. This more compact drive gives you more horsepower per dollar, results in substantial savings, both in initial costs and often in belt replacement.



ORDINARY DRIVE — MAXIPOWER DRIVE

In most Maxipower installations, fewer belts and smaller diameter sheaves are used, center distances are shorter. Costs can be cut up to 30%, valuable space is saved. Sheaves have narrower grooves and groove spacing, are smaller, less costly. The smallest sheaves that can safely be used with the drive motor can be installed. Often these will be 50% smaller than present drives. This reduced sheave weight and face width means less shaft overhang, less bearing load—increased bearing life.

The extra strength of Maxipower V belts comes from its new rubber compounds, the tough fibers used in its load-carrying cords, and the new "deep V" design. Because of this design the belt's load-carrying cords are supported so completely that each has an equal share in the load—none "loaf".

All Maxipower V belts are heat-resisting, oil-resisting at no extra cost. Belts with static conducting properties can also be ordered *at no extra cost.*

For further information and help in selecting Maxipower belts for your drives, call your B.F.Goodrich distributor. *B.F.Goodrich Industrial Products Company, Dept. M-792, Akron 18, Ohio.*

B.F.Goodrich V belts

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Articles in this issue of

ENGINEERING AND MINING JOURNAL

Continued from p 2

89 **Will the Technology of the 50's Carry Over to the 60's**

The Annual Survey Issue is introduced this year with a brief study of where we've been and where we're likely to be going. Keeping in mind the note in December's Editorial that "the engineer-science team will probably be the most disturbing influence—for good or bad," we have found it worthwhile to question the march of technology in the industry.

On subsequent pages, the editors have collected twelve examples of mining's progress in the 1950's. Each represents the expenditure of millions of man-hours and millions of dollars, and each represents a bench mark in the progress of the mining industry and the economy of the world.

Following our panorama pages, we have again gathered the major mineral industry projects now under construction, completed last year, or in the planning stage—with their timetables. The collection promises another, and larger panorama for the future.

97 **The Metals, Ferroalloys and Nonmetallics**

Reviews of 43 commodities, their history in 1959 and their expected future in 1960 and beyond, fill the pages from 97 through 158. Authors from industry and the U.S. Bureau of Mines have gathered valuable material on each commodity and now present it as a guide to the future.

Strikes were the big story in 1959, and boom appears to be the story for '60. Surprisingly, many industrys report that the steel and nonferrous strikes had a less severe effect than was expected. Apparently the economy and the mining industry was recovering nicely in late 1959 and looking forward to some spectacular doings in the new year. There were low spots on the domestic scene, once again in those areas where foreign production strengthened.

Broadening markets appeared last year, for old metals as well as for the newer, more exotic ones. And, once again, the Government's role was dominant in many areas.

22 **Whither Cuba's Mineral Industry?**

E&MJ's Washington correspondent spent ten days last month on the unsettled island of Cuba. He reports that, while the government of Fidel Castro shows expropriatory interest in much of the country's industry, it seems to respect the mineral industry and what it represents as a future source of economic strength. His analysis of Cuba—and Castro—today, appears on p 22.

176 **How Did the Mining States and Mining Nations Fare?**

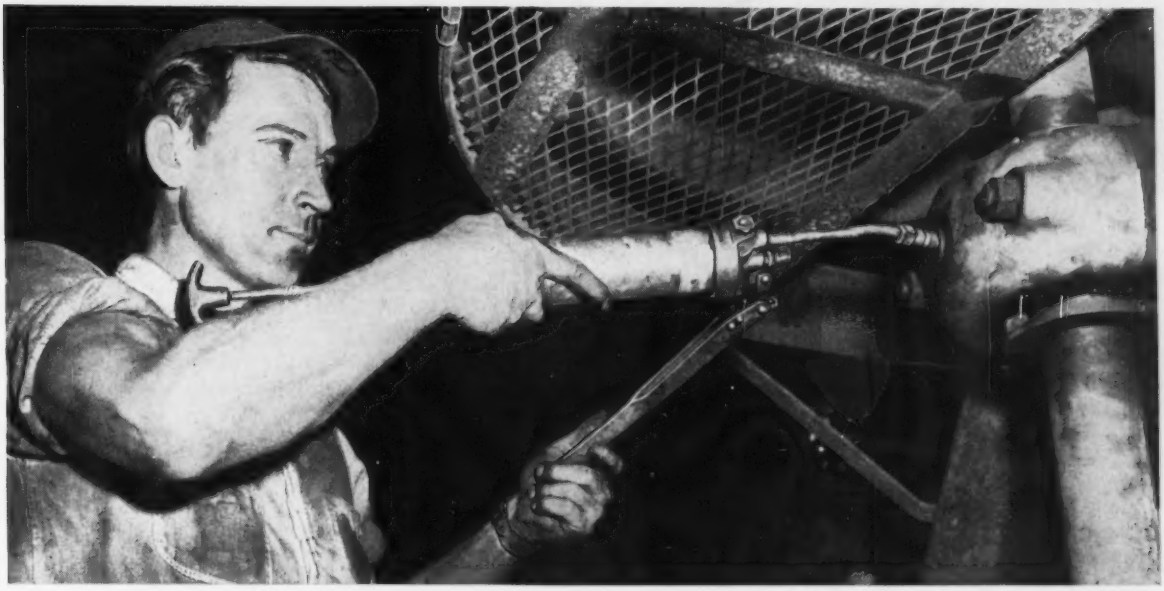
Back in the regional news section of this issue appear reports by E&MJ's more than 60 correspondents in the U.S. and abroad. This month, along with their regular reports on what's happening in the mining industry, they've included regional summaries of last year. There's news of new mines, new developments at old mines, and a pretty good indication of what we've accomplished—standing on the threshold of the 60's.

ENGINEER'S FIELD REPORT

PRODUCT CHEVRON INDUSTRIAL GREASE

FIRM CALERA MINING CO. Cobalt, Idaho

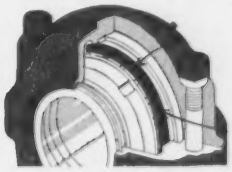
Bearings last 800% longer using Chevron grease



Escaping 240° steam caused bearing failures in only 2 months on this ore conditioner at Calera Mining Co. until firm changed to Chevron Industrial Grease. Now, identical bearings lubricated with this moisture—high temperature-resistant grease last 18 months, 800% longer...need lubrication just once each 24 hours instead of 3 times every 8-hour shift. Bearings are pillow blocks for 17½' impeller shaft which churns ground cobalt ore with steam, air and lime to aerate it prior to differential flotation.

Mill Foreman J. O. Vecchies (right) and V. Fliflet, Standard Oil Representative, stand on 15' diameter ore conditioner to examine bearings and impeller drive. Replacing these 3-3/16" taper roller bearings is a 4-hour, 2-man job, and shuts down entire mill. Increased bearing life with Chevron Industrial Grease saves the equivalent of 64 hours labor, with a corresponding increase in productive capacity. Mill is only source of cobalt in Western Hemisphere. Firm has used Chevron Industrial Grease since 1955.

Why Chevron Industrial Grease provides superior lubrication



- Top wear-prevention qualities
- Pumpable over wide temperature range
- Mixes with any grease
- Extreme work stability
- Melting point, 500°F. plus
- Rust protection
- Non-corrosive
- Unusual water resistance

For More Information on Chevron Industrial Grease or any other petroleum product, or the name of your nearest distributor, write or call any of the companies listed below.

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THE CALIFORNIA COMPANY
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93 YEARS OF MINING

The following news items are reprinted, substantially as they first appeared in the AMERICAN JOURNAL OF MINING, the publication which subsequently became the ENGINEERING & MINING JOURNAL. The column will appear in this space monthly.

NEW ALMADEN, APRIL 1866 — It was accidentally discovered that the slag from the furnaces of the New Almaden quick silver mines contained a noticeable quantity of gold. Samples have been submitted to a number of assayers in this city, all of whom have returned gold, from $10 to $20 per ton.

BIRMINGHAM, MARCH 1866—Titanium metal has been obtained in considerable quantities, by reduction with sodium, the resulting powder being fused into compact masses of large size; the similarity of titanium and iron is striking. Little doubt . . . that ere long the new metal will be produced at above the price of silver, in which case many practical applications could be found for it.

THE COMSTOCK, MARCH 1866—A few mines here will have to change their superintendents and one its president. The superintendent of the Gould and Curry mine keeps no fast horses at the expense of the company, and what is more reprehensible, he has changed the mine from a non-paying mine to a dividend paying mine and . . . has the welfare of the mine at heart. This will never do. It is vulgar.

BRITISH COLUMBIA, MARCH 1866 —Route from San Francisco to the Big Bend Mines, via Portland.

	Time	Fare
From San Francisco to Portland	3½ days	$25
From Portland to Walla Walla by Steamer, 210 miles	4 "	18
From Walla Walla to Colville, 240 miles	9 "	walk
From Colville, by steam to Little Dalles, 250 miles	4 "	20
From Little Dalles to the mines, 60 mi	2 "	walk
Total	22½ "	$63

This month in

ENGINEERING AND MINING JOURNAL

Continued from p4

Behind the By-Lines

In this uneasy era of conformity you might be cheered to learn that there are still some individuals who can adapt to changing times and challenges.

A recent issue of the Alaskan Division of Mines BULLETIN makes mention of "old timer Fred Wackowitz," who normally operates several prospects in the Fourth Division.

This year, the publication notes, Fred "mined cranberries instead . . . and cornered the Fairbanks market in the recent cranberry excitement."

We've been waiting, with some apprehension, for news of a claim staking rush in the area of Mt. Wheeler, Colo. (November, p 18) where some pretty exciting beryllium news has been breaking.

The cause of our fears was a mistake of our own—we quoted values at the property "averaging 75% BeO." Fortunately, our readers are obviously much smarter than we are, and put the decimal point where it belonged, in front of the figure seven, to read 0.75%. And even more fortunate, no one has reported selling the old homestead to dash out and claim a piece of ground. Another, and less forgivable oversight—created in our haste to get a late-breaking story into the book—was the consistent misspelling of the word pegmatitic. Apologies to all, and particularly to some former professors who already have trouble enough.

And speaking of conformity, perhaps we may all have to get in line after all.

The office staff of the medical examiner's office of the M. A. Hanna Co. ran a study on 1,219 miners a month or so ago, and found that the "average" miner is 5 ft 9-in. tall and weighs 174.5 lb. Fourteen men in the group weighed less than 125 and 185 weighed over 200 lb. Ninety-nine of the subjects were under 5 ft 6-in in height.

But we wish the researchers had been a bit more specific. Several questions remain disturbingly unanswered: Did any of the minus 5-ft-6 boys come under the plus-200 lb heading? Couldn't we have gotten just one more guy to admit to minus 5 ft 6-in. if only to make it an even one hundred? Was the measuring done before or after lunch? That's research for you—always prompting more questions than it answers.

In the rush of last month's issue, we failed to take note of the sale of the Denver MINING RECORD by Charles E. Newmeyer to a group of Denver newspaper men. We rank ourselves among Mr. Newmeyer's staunchest admirers, and view his departure from the publishing scene with real regret; welcoming at the same time his successors. At a time when independent publications are dying out, it is heartening to see at least one being handed on to enthusiastic craftsmen.

We've been swapping Vermont farmer stories with one of our colleagues for years now, and he's just passed on a candidate for typical-New-England joke of the year.

Seems one such tiller of the soil had a barn built by a contracting firm. He replied, on being asked what it cost:

"Cost more than I thought it would.—And I thought it would."

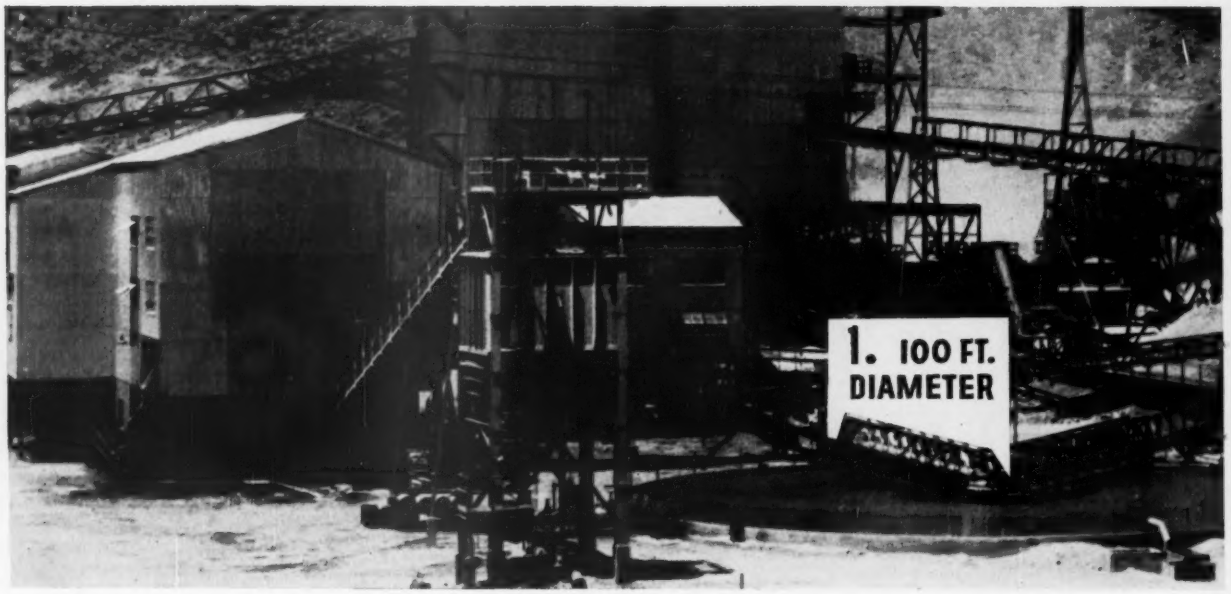
NYGEN-BUILT

GENERAL TIRES

keep your units moving full steam hour after hour . . . job after job . . .

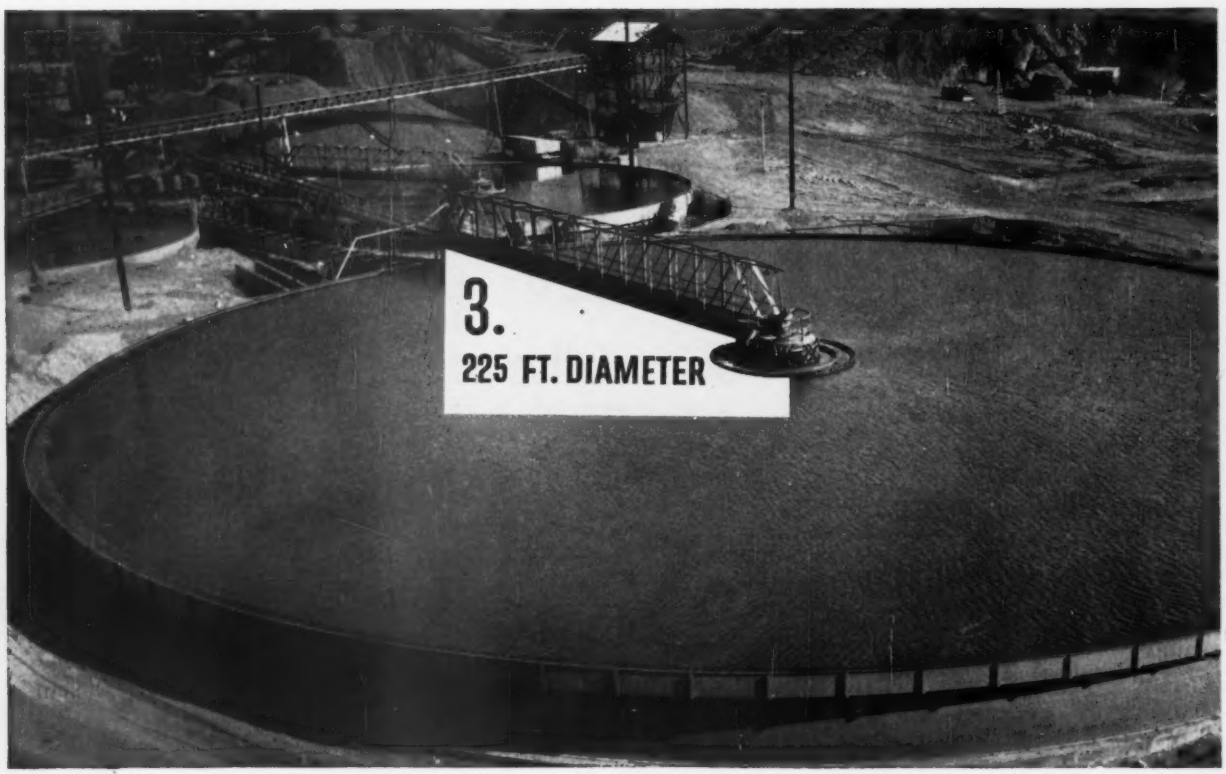
Whether it's sand, mud or the rockiest grade . . . the General Tire keeps rolling to keep projects on schedule. With exclusive Nygen-cord construction, the General Tire defies the worst job hazards while its heavy, husky tread provides traction beyond comparison. You get maximum flotation, minimum rolling resistance, too! That's why the tough-built General Tire keeps going whatever the going! See for yourself on your next job!

THE GENERAL TIRE & RUBBER CO. Akron, O.



THIRD DORR THICKENER

Kaiser Steel again expands facilities



INSTALLED AT EAGLE MOUNTAIN

at West Coast iron ore concentration plant

Matching the demands of West Coast steel production has involved a continuous expansion of Kaiser Steel's iron ore concentration plant at Eagle Mountain, California.

This expansion is demonstrated in the photos shown here. Initial Dorr-Oliver equipment installed at the plant included a 100 ft. dia. Dorr Thickener. In 1956, a 125 ft. dia. unit was added. Now a third Dorr Type S-800 Thickener, 225 ft. in diameter, is in operation.

The new unit is designed to handle approximately 2400 tons per day (dry basis) of low grade iron ore and gangue. Feed is 14 to 16 thousand gallons per minute of slurry containing 2% to 4% solids. Hinged rake arms raise to prevent stalling when overloads occur and automatically lower to normal position as continuous raking corrects the condition.

For more information on the complete line of Dorr Thickeners, write for a copy of Bulletin 3001. Dorr-Oliver Incorporated, Stamford, Connecticut.

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Goodyear makes rims in widths up to 37" and diameters up to 49". To prevent premature tire and rim failure, it pays to buy and specify rims job-fitted by Goodyear. See your local rim distributor, or write: Goodyear, Metal Products Division, Akron 16, Ohio.

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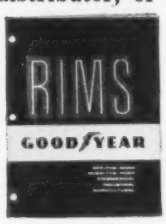

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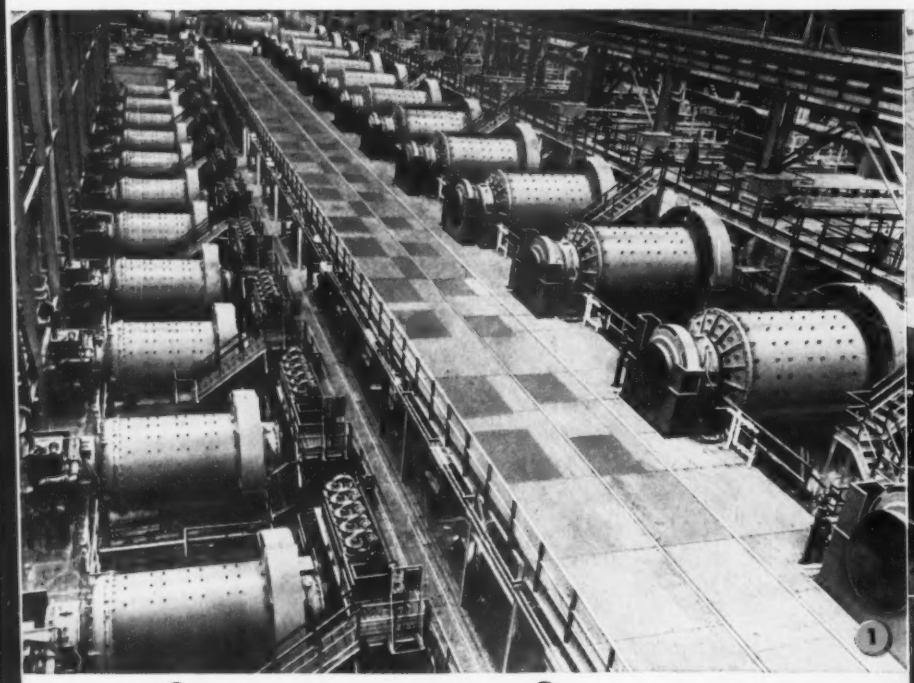

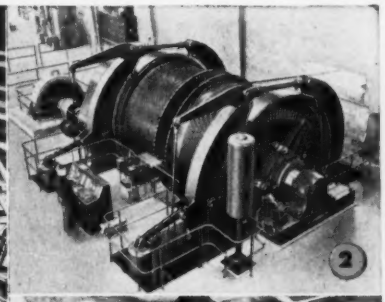

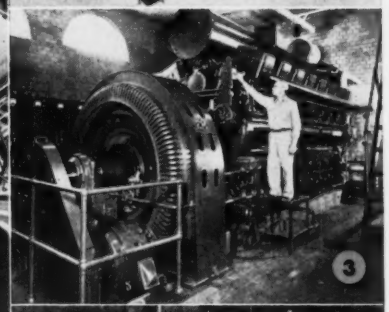

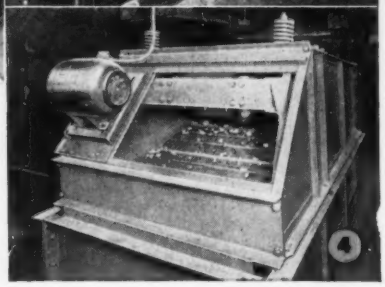

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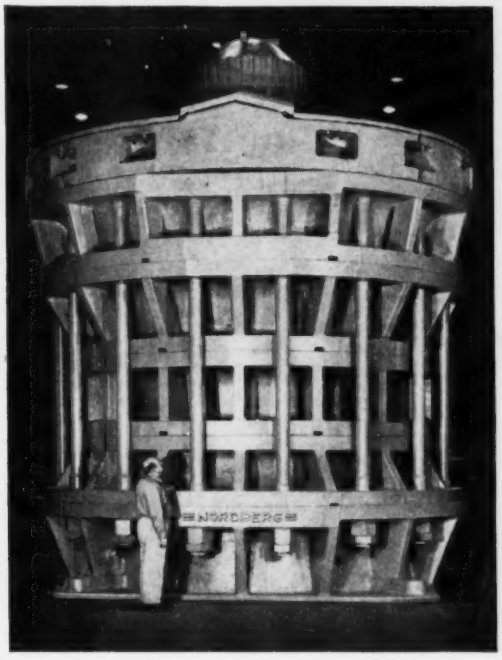
Built in 11 different sizes, ranging from 22″ to 7′ dia., for capacities from 6 to 900 or more tons per hour.

(Illustrated at the right is a typical installation of Symons Cone Crushers and Rod Deck Screens serving a large Taconite Iron Ore producer).



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M158

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Two Marion 4161 machines are helping to point the way to high grade recovery of low grade ore in the Lake Superior region.

The diet of these machines is a hard, abrasive Jasper formation weighing 2.6 tons per yard. The Marions work on 40 foot benches in blasted pits ranging to 100 foot depths which may eventually reach 500 feet.

Let Marion mining machines, in a broad range of sizes and types, help you get high grade, high profit results.

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12 million tons in 9 years and still on the job

Belting out a soggy stream of gravel–at a hustling 450 t.p.h.–is a rugged assignment. So the owners of this busy Northwest gravel pit expected maintenance problems from any conveyor belt they'd choose for gravel stockpile duty.

But they were in for a real surprise from the special belt recommended by the G.T.M.–Goodyear Technical Man. At last report, it had handled 12 million tons during 9 tough years of use–needed little maintenance and no shortening–was still doing a standout job. That kind of performance so impressed this operator, it sold him several other Goodyear conveyors.

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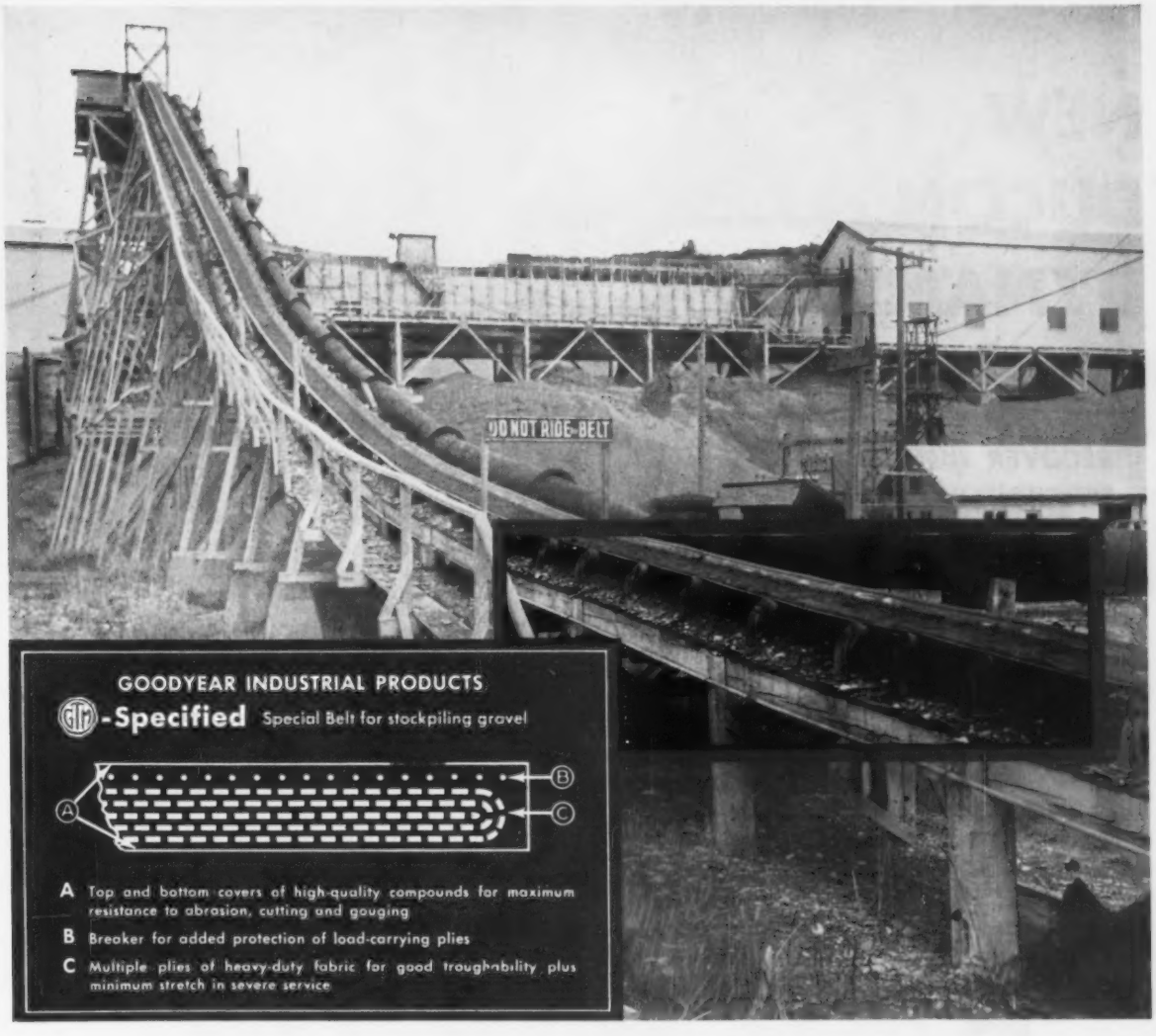
IT'S SMART TO DO BUSINESS *with your Goodyear Distributor. He can give you fast, dependable service on Hose, V-Belts, Flat Belts and many other industrial rubber and non-rubber supplies. Look for him in the Yellow Pages under "Rubber Goods" or "Rubber Products."*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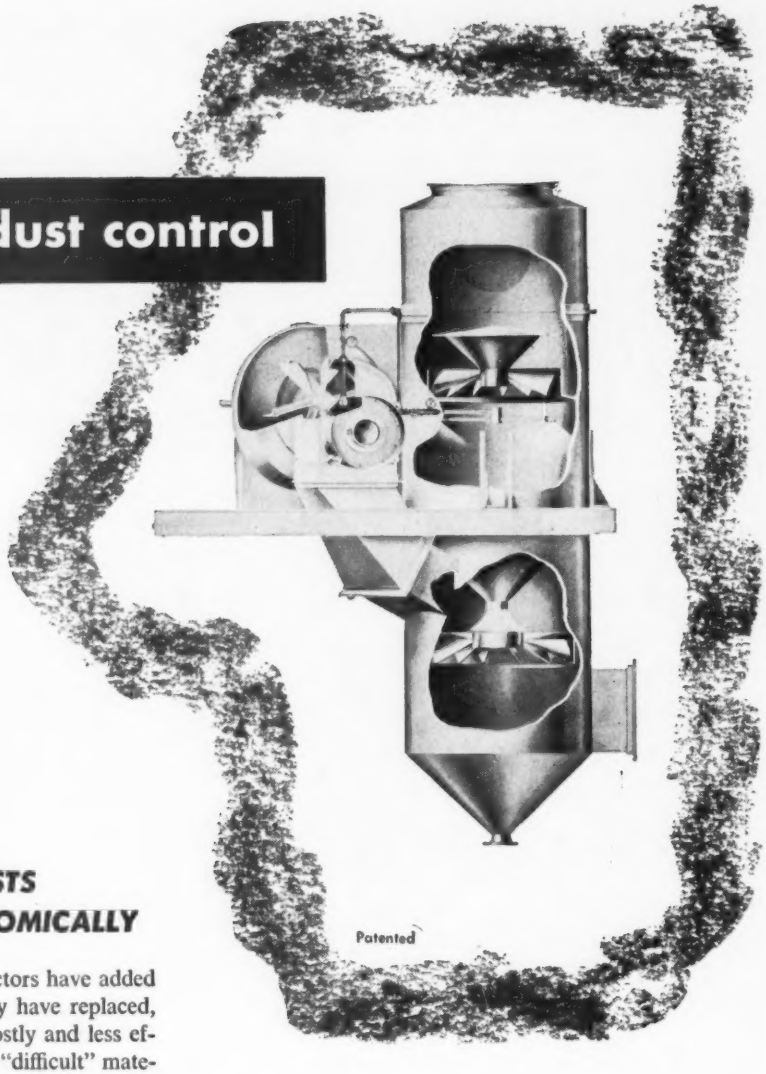

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RECOVER DIFFICULT DUSTS EFFICIENTLY AND ECONOMICALLY

Ducon UW-4 Dynamic Wet Dust Collectors have added a new dimension in dust recovery. They have replaced, with outstanding success, many more costly and less effective dust collectors in the recovery of "difficult" materials, such as fine and abrasive dusts in kilns, rotary driers and other applications.

The UW-4 Washers are also ideal for high loading conditions where maximum efficiency is desired.

Ducon UW-4 washers offer other unique advantages, including constant air capacity, low water consumption and rugged construction. They are self-cleaning and fire and explosion proof.

For complete information write for Bulletin W-7456.

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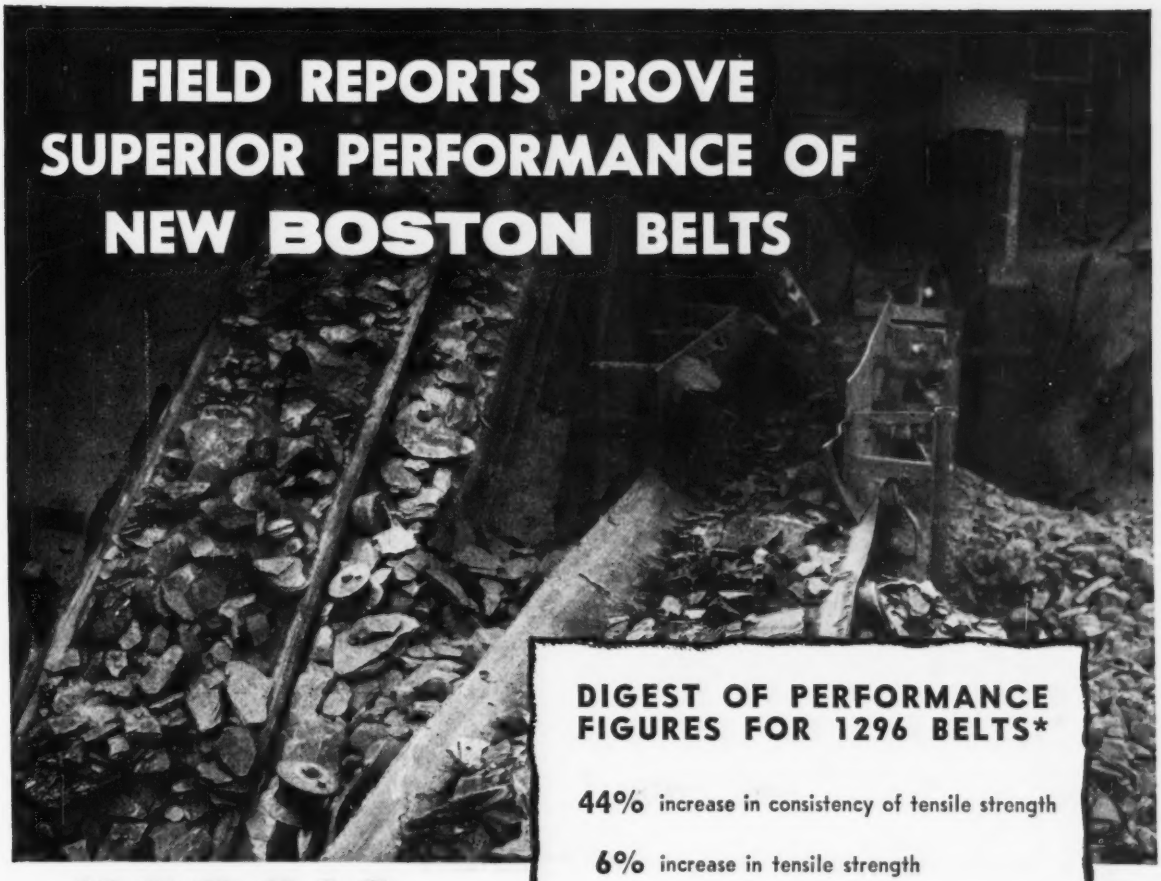
FIELD REPORTS PROVE SUPERIOR PERFORMANCE OF NEW BOSTON BELTS



DIGEST OF PERFORMANCE FIGURES FOR 1296 BELTS*

44% increase in consistency of tensile strength

6% increase in tensile strength

130% improvement in consistency of elongation

* Compared to belts previously manufactured

HERE'S WHAT DOES IT!

The startling figures above are a direct result of two major belt manufacturing advancements — both developed by, and exclusive with, Boston Woven Hose & Rubber Co.

ADVANCEMENT #1 **BALANCED BELT CONSTRUCTION** for the first time equalizes ply stress so that each ply pulls its full share of the load. **BBC** eliminates lazy plies. A BOSTON exclusive because only BOSTON can combine Electronic Tension Controls with Rotocure, the continuous method of vulcanization, which assures uniformity throughout the belt.

ADVANCEMENT #2 **DULON** markedly improves the aging characteristics of BOSTON belts. An exclusive BOSTON research development, the tough specially treated cover compound stays resilient longer . . . makes the belt much more resistant to abrasion, gouging, tearing and oxidation.

BALANCED BELT CONSTRUCTION plus **DULON** add up to longer belt life . . . less trouble in service . . . greater economy.

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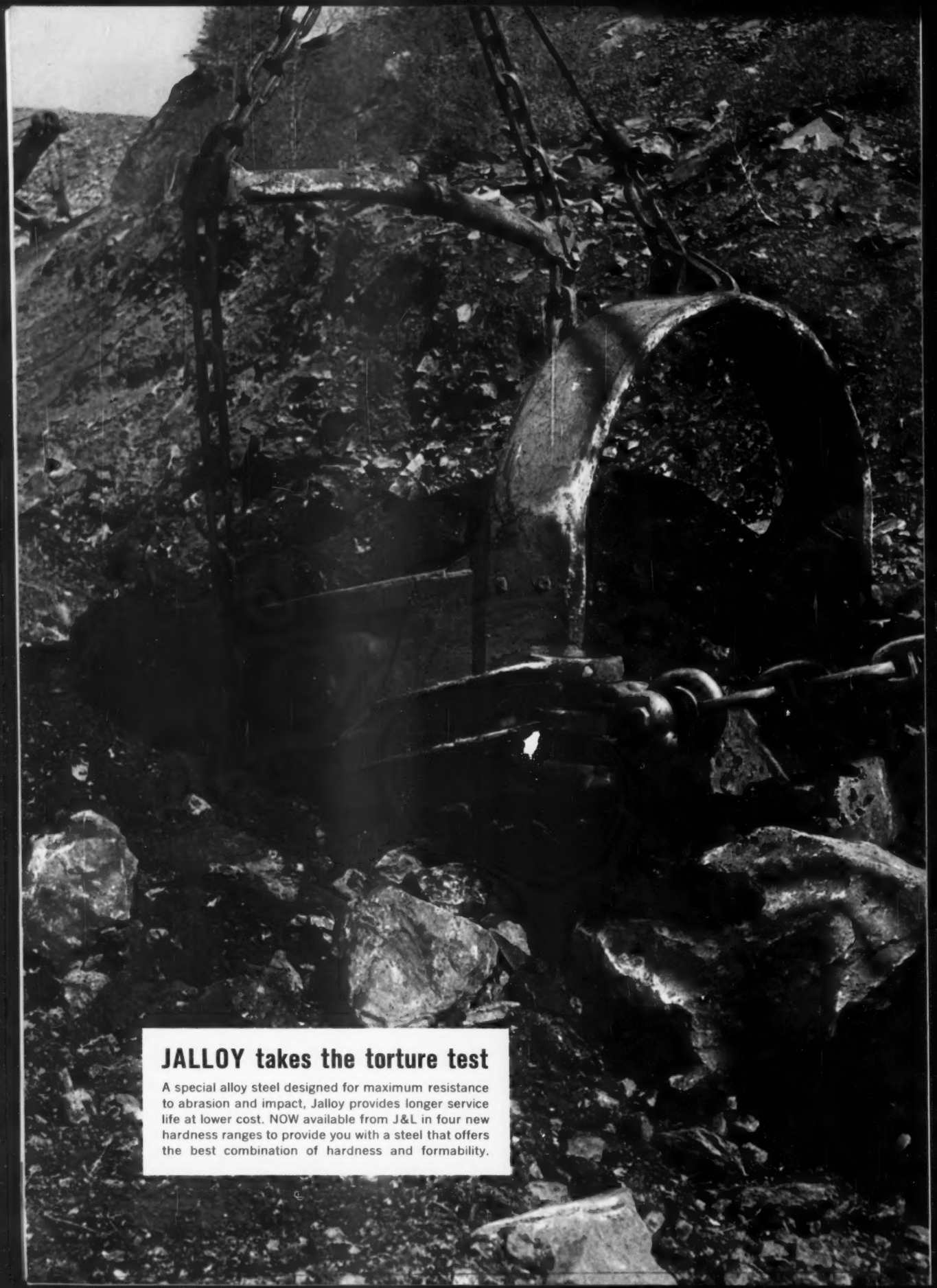
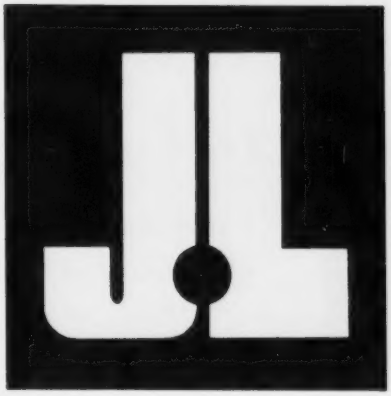

JALLOY takes the torture test
A special alloy steel designed for maximum resistance to abrasion and impact, Jalloy provides longer service life at lower cost. NOW available from J&L in four new hardness ranges to provide you with a steel that offers the best combination of hardness and formability.

Jalloy is tougher, by three to four times, than the ordinary mild carbon steel used in conventional buckets—two to four times as resistant to atmospheric corrosion.

Jalloy is readily flame cut, easy to weld. It provides longer wear and less repair.



Jalloy is produced in four new hardness ranges to provide the flexibility to meet various needs. All four are used in this bucket.

Jalloy plates measuring 6′ x 20′ are cold formed to a 96-inch radius for this mammoth 9-yard dragline bucket.

Recent field tests show Sullivan Trail buckets are stronger, lighter, longer-lasting by at least 30% because . . .

bucket arches & skids & backs & bottoms & bucket jaws are all J&L JALLOY steel

Rugged strip mining operations in the anthracite coal fields around Wilkes-Barre, Pa., demand rugged dragline buckets.

A mining expert with the Sullivan Trail Manufacturing Company, West Pittston, Pa., says:

"Frequent and major repair work on conventional buckets pointed up the need for a bucket that would last longer and have greater strength with less weight."

Design of a new super-bucket began nearly five years ago with the selection of a special heat-treated alloy steel—JALLOY—for bucket areas subjected to severe stress, strain, impact and abrasion. Since then the Jalloy bucket has undergone severe field testing which indicates a 30 per cent longer life.

Recently, through close coordination with J&L's Technical Service Department, Sullivan Trail has saved money and simplified fabrication of the new bucket. By introducing a variation in heat-treatments, J&L developed a new series of *four* Jalloy hardness ranges. Each provides a different combination of formability and resistance to impact and abrasion. The Sullivan Trail bucket now employs all four Jalloy ranges.

If you have a similar problem, Jalloy is your answer. Contact your nearest distributor or J&L district office and ask about Jalloy. Or, write directly to Jones & Laughlin Steel Corporation, 3 Gateway Center, Pittsburgh 30, Pennsylvania, for the new booklet entitled *Jalloy*.

Jones & Laughlin Steel Corporation

PITTSBURGH, PENNSYLVANIA

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more *working* pool area per dollar

gives lower cost

- **dewatering**
- **recovery of fine solids**
- **sand-slime separations**
- **closed-circuit grinding**

Other Exclusive Akins Features...

- **starts without unloading**... mechanical lifting mechanism permits raising spiral when shutting down, and starting up again without unloading tank
- **submerged bearing** gives trouble-free operation, low maintenance.
- **lubrication** through pipe in main shaft assures positive flush lubrication of all bearing components
- **half-diameter spiral pitch** gives maximum raking capacity, minimum slippage and wear
- **overflow box** with pipe fitting is furnished as standard

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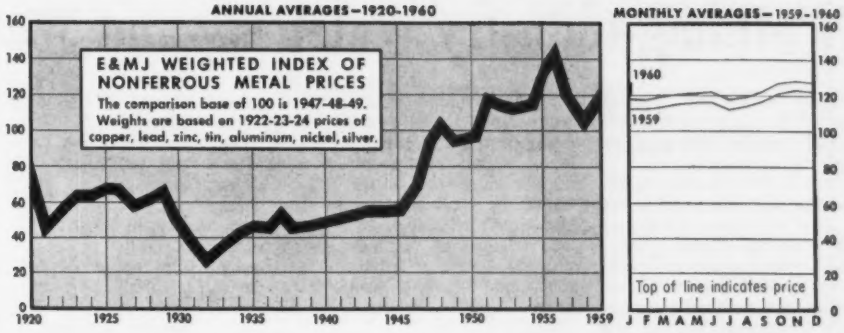
E&MJ OUTLOOK

PRICES



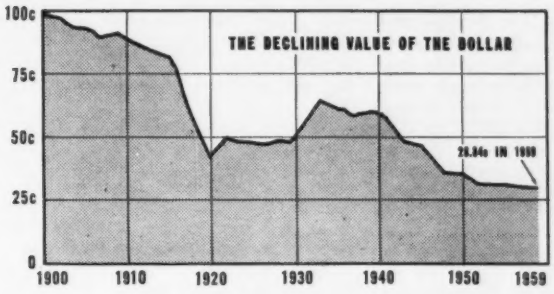
MARKETS

E&MJ's nonferrous metal price index dropped from 128.1 in December to 127.8 in January. Lower copper and lead prices accounted for the drop. Zinc, tin and aluminum were up slightly.

●

AT HOME

The American dollar is worth less today than at any time in history; less than when the Constitution was adopted, according to the United States Chamber of Commerce. As shown in the accompanying chart, the purchasing power of the dollar has declined from 100 cents to less than 20 cents during the 20th Century. The Chamber blames deficit spending by the Federal Government as the main cause for the declining purchasing power of the dollar. The Chamber is calling on Congress to hold the highway program to a pay-as-you-go basis; avoid wasteful defense spending; and eliminate unnecessary spending for public works, depressed areas, community facilities, veterans' benefits, and airport construction.



Domestic iron ore resources are estimated at about 75-billion tons of crude ore, according to Interior Department estimates. Of this total, about 10-billion tons are classed as reserves of material usable under existing economic and technological conditions.

A 55-ton capacity ore truck with electric four-wheel drive system was demonstrated by Unit Rig & Equipment Co., Tulsa, Okla., recently. The motorized wheel eliminates torque converters, transmissions, propeller shafts and drive axles.

●

LABOR

AFL-CIO political strategists plan to wait until next year before pushing for overhaul of the Taft-Hartley and Landrum-Griffin labor laws. See p 25.

●

ABROAD

The stretch-outs and contract switching have begun in Canada's uranium industry. Gunnar has agreed to sell concentrate to Rayrock and Canadian Dyno to fill the balance of their contracts. Similar maneuvers are underway in the Union of South Africa. Ellaton mine has sold the balance of its contract to its neighbor, Afrikander Lease. See Uranium Review p 108.

Increasing Japanese demand for copper is stimulating the reopening of mines, and the search for ore in Australia. Twenty proven mines were reopened in the Einasleigh district, about 900 miles north of Brisbane.

Japanese steelmakers have been looking for new sources of iron ore overseas for their steel industry. Their choice is Africa, rather than Canada, Australia or even India. Kobe Steel is preparing to develop South Rhodesian ores, and Yawata Iron & Steel and Fuji Steel, those in Swaziland. The iron content of ore is about 62%.

THIS MONTH IN MINING

Cuba's Mining Industry Watches—and Waits

WITH U.S.-CUBAN diplomatic tensions pulling tauter by the week, a quarter-billion dollar U.S. mining stake in Cuba is riding a highwire of uncertainty.

Yet so far, Cuba's metal-mineral industries—foreign and domestic—have suffered less than any other enterprise on the island from the Castro revolutionary regime's nationalistic economic policies. And the outlook for the future, barring of course such political extremes as a complete Communization of the government, indicates Cuba may be able to increase its production and export of ores and concentrates, perhaps expand to metal fabrication.

In a maze of confusion, this much is clear: Whoever controls Cuba in the immediate years ahead, the Government will continue a concerted effort to put the nation on the map as a supplier of metal-mineral commodities and products. Cuban leaders of all political shades agree the biggest single economic problem facing the country today is to diversify its essentially one-crop sugar economy. Along with agricultural diversification, mining has been selected as one of the best potential candidates to accomplish that job.

The effort itself is not new. But under prime minister Fidel Castro it already has been tagged top-priority and intensified. Many mining experts express serious doubt that Cuba can reach the admittedly ambitious goals of metal-mineral production the present regime has set. But the attempt alone could have an important impact on international trade and investment in minerals.

Castro, and his more radical advisers, would like to see Cuba bolster its mine output on its own, without the help or even cooperation of U.S. interests. However, experts say Cuba must have foreign financial and technical aid.

Realistically, Cuba has only two places to turn for that help—the U.S. or the USSR. Moscow hasn't come up with much more than talk so far either, nor has Castro committed himself to Soviet aid.

It is on the basis of these assumptions that international mineral traders and investors in Cuba today are betting that Castro will continue to take a relatively more accommodating line with private mining interests than he has with other foreign and domestic enterprises—if only from fear of economic collapse.

Should Washington adopt strong economic pressure policies toward Cuba, they naturally would pull the rug out from under Castro's mining development plans. But up to now, neither the Administration nor Congress has shown a willingness to take measures which would hurt the basic Cuban economy and thus risk real resentment that might strengthen Castro's political grip.

Cuba has both need and potential for mineral development. The need stems from the fact that Government officials now privately concede that Cuba is going broke internationally—owing some $50-million more than it has in its reserves on back remittances alone and faces "incipient" inflation in its domestic economy because of vast new public works projects aimed at artificially producing jobs and consumer spending to keep people happy.

Cuba's potential lies in nickel, cobalt, manganese, copper concentrates, chrome, iron ore, and nonmetallic minerals. It also produces and exports small quantities of gold, silver, gypsum, lead and zinc.

These already comprise Cuba's third largest industry behind sugar and tobacco, and probably the island's third largest dollar earner ($40-million a year) behind sugar now that tourism has fallen off drastically.

Freeport Sulphur Co.'s $120-million new nickel-cobalt-ammonium sulphate slurry operation at Moa Bay could substantially increase Cuban mineral earnings alone. Its estimated annual output of 25,000 tons of nickel, added to U.S. Government's $80-million 27,000-ton-per-year mine at nearby Nicaro could make Cuba the world's second largest nickel producer behind Canada.

Until Freeport set up Moa Bay, U.S. mining interests in Cuba followed a frankly designed policy of caution in developing their claims. So, too, did many private Cuban claim holders, who now make up the bulk of mining investment on the island. Partly this was due to political uncertainty, partly to the need for extensive financing to upgrade medium or low-grade ores, but mainly to a lack of trained technicians.

As a result, Cubans have long resented the admittedly prevalent practice of some claim holders of "sitting" on large properties without developing them as much as they might, and evading taxes by declaring smaller export shipments than they actually sold.

The government late last year passed a tough mining reform law which puts a $100 fee on all mining claims, a tax of $10 per hectare (2½-acres) on claims being exploited and $20 on claims lying idle, a 5% duty on production and a prohibitive 25% tax on exports.

Early in January, however, it offered all privately-owned mines an alternative to the export tax: turn over to the Government their output, which it would then sell on the world market at the highest possible price. The Government would return 95% of that dollar price to the owner, in Cuban pesos (still officially on par with the dollar), keeping what amounts to 5% production tax.

Moa Bay has agreed to the deal in principle as something it can live with. Officials of the company are now negotiating with the government to determine the production value on which the 5% will be collected. Moa Bay claims its slurry product, which has to be shipped to Freeport's Port Nickel processing plant in Louisiana, is worth only 55% of the value of the finished product.

Moa Bay already has shipped its first test load of nickel-cobalt slurry to its sister plant at Port Nickel, tax-free. Another shipment is awaiting official approval. Freeport will have other problems with the Cuban government even if the 95-5 deal is worked out. Castro now permits no exchange of pesos for dollars, thus raising the question of how Moa Bay can repatriate any profits or pay its dollar remittances to Freeport. But company officials are hopeful Castro will cooperate.

Freeport is in a unique position at least for the present because its Port Nickel plant is the only one equipped with a new process to finish Moa Bay's slurry. There is industry talk that Russia is working on a similar process, but is not yet prepared to buy concentrate.

As Federal property, the U. S. Government's nickel mining plant at Nicaro is also in a special position. Castro has given it a three-month grace period to resume—tax free—shipments halted under the new mining law last Fall. He also has bid to buy the plant, which General Services Administration has up for sale. But nickel mining experts say Castro does not have the trained personnel to run either Moa Bay or Nicaro, so probably will not seize them.

Unquestionably Castro intends to put the Government in the mining business through his monolithic agrarian reform institute (INRA). INRA has earmarked part of its 1960 budget of $150-million for mineral development, and is again exploring the often-discussed possibility of building a copper smelter.

But both foreign mining interests and international ore traders are betting that INRA will avoid totally stifling private enterprise in the mineral field. Under a new tax reform law, private investment in mining and other industries tagged high-priority by the Government is allowed substantial incentive reductions and exemptions, and for the first time in Cuban history, fast amortization. A new credit crackdown leaves exemptions for loans to mining interests. INRA has hired trained mining engineers from Mexico to survey what needs to be done in Cuba. Castro's industrial and agricultural development lending agency (BANFAIC) has earmarked several million dollars to lend to private mineral developers. Government officials say they are arranging barter deals in Europe for the exchange of mineral production for industrial machinery on which U.S. suppliers have stopped short and medium term credit.

As We Went to Press . . .

An example of the problems connected with mining in Cuba is the experience of Bethlehem Steel Corp's half-century attempt to develop iron ore production there. A several-million-dollar plant so far has been able to turn out only a mixed ore, heavy in a nickel-cobalt content, which has application in a limited market for high-tensile steel.

Bethlehem officials say they have tried for years to come up with a processing technique which would broaden its Cuban product's application, but so far have not found the answer. As a result, Bethlehem today is confining its activities to supplying Nicaro and Freeport with nickel and cobalt ore.

It is this kind of technical problem the Cuban regime feels U.S. companies have been "too slow" in solving. One project INRA is certain to tackle is iron ore processing. But it is a question Cuba will have any better success.

Some ore traders are openly, if controversially, bullish about the possibilities for Cuban mineral development. They say they are betting that except for a few new operations, Castro will not move the government into mine production, contenting himself with controlling the trading of the production.

One international mineral trader also predicts European investment money will begin to trickle into Cuban mines this year—in three to four months—barring of course a complete Castro turn to the left or his government's collapse.

A New York investment house representative goes so far as to claim he knows of as much as $500-million in U.S. investment he could arrange if Castro would give the barest of guarantees. So far those guarantees have been refused, and little new U.S. investment is coming in. One new deal involves $1.8-million which Phelps-Dodge Corp. plans to put into expanding its copper wire fabricating plant near Havana.—JOHN DONALDSON

Cerro Moves Rio Blanco; R. F. Goodwin Is Named

A NEW Chilean copper mine is in the making, 35 miles northeast of Santiago, where Cerro de Pasco Corp. has been investigating the property which it purchased from Compania Minera Rio Blanco (E&MJ, July 1956, p 101).

Development plans call for a mine and mill at a cost of approximately $70-million with the possible addition of a smelter at the site, which would raise the estimated cost to $90-million. Production of 68,500 tpy of refined copper is envisaged from the project.

Richard F. Goodwin, former director and chairman of the executive commit-

(This Month continues p. 172)

A $20-million trona plant, northeast of Green River, Wyo., proposed by Stauffer Chemical Corp. officials, will grow or die depending upon the decision of the state Natural Resources Board. The U.S. Bureau of Reclamation opposes the plant, noting that dropping of 6,000 to 12,000 acres of irrigable land from the proposed Seedskadee reclamation project (where the trona deposits are located) would defeat the effectiveness of the plan.

One of the largest Great Lakes carriers ever built, the Edward L. Ryerson, was side-launched Jan. 21 at Manitowoc, Wis. The carrier has the maximum dimensions permitted for Lakes craft of 730 ft length and a 75-ft beam. Capacity is 27,000 gross tons.

Mt. Isa Mines, in Queensland, Australia, will spend $7-million to double ore-treatment capacity, with completion set to coincide with opening of the expanded rail haulage facilities (E&MJ, December 1959, p 19). Ore throughput will increase from 8,000 to 14,000 tons per day.

Oliver Iron Mining Division has bought 2,500 acres of land near Mt. Iron at a St. Louis County tax sale of forfeited lands. The U.S. Steel subsidiary has announced that the land may be used for a taconite development. Oliver also purchased a 384-acre tract near Ely, Minn. for a possible washing plant site to treat ore from the Pioneer mine.

Unveiling of what is called "the world's first airborne gravity gradiometer" took place at the Calgary symposium of Arctic Geology (see p 238). The gravity gradiometer was developed in the Toronto research laboratory of Lundberg Explorations, who intend to operate it around the world. The instrument is described as basically a sensitive electric balance composed of two substantially similar masses, suspended on thin filaments, one above the other. A variable condenser is located near two masses. When the instrument is flown over density differences, the masses change their position relationship, and the movement (measured accurately to a hundred millionth of a centimeter) is recorded.

The Senate's Mining Bloc is pushing a new minerals conservation act, proposed by Interior Committee chairman James Murray (D-Mont). The proposition, still in its formative stages, would set up a three-man council of resources and conservation advisers, appointed by the President and the Senate, to recommend policies for conservation and development.

An 11-man Japan-U.S. joint survey team arrived in Conakry, French Guinea late last month to start development of the huge iron fields at Nimba, near the Liberian border. Early discussions involve the Japanese trading firm of Kinoshita Shoten and the firm of Guinea American International.

Texas Gulf Sulphur will build a filtration plant for sulphur at Spindletop, near Beaumont, Tex., at a cost of approximately $1-million. The plant is designed to "upgrade" T-G's dark sulphur (See p 176).

WASHINGTON IMPACT

Highlights

THE COMMISSION AND THE CONGRESS—Its hearings on lead and zinc on the record, Tariff Commission is in the home stretch toward one of the most difficult and controversial reports it has ever been required to make. By early April, the Commission will send to Capitol Hill its "specific findings of fact" as to what—if any—new protection is needed by the domestic lead and zinc industries.

The only certainties at this point are that the decision will be split, and that its findings will entirely satisfy neither the domestic producers who are seeking additional protection nor the international producers, processors, traders and unions who favor a gamut of solutions ranging from slightly higher tariffs to removal of import quotas.

One straw in the wind late last month was a Commission rejection—by a 3-2 split vote—of domestic zinc sheet and plate producers pleas for escape clause tariff relief. But Washington observers are not reading this decision as a definite indication the Commission will rule against domestic producers in its broader study. Mining experts say the sheet and plate producers case suffered from the fact they could not show more than approximate 4% increase in import competition.

Domestic lead-zinc mines are hoping for at least some support in the Commission report along the following lines:

- A suggestion that Congress should help economically distressed producers with a new incentive purchase, price support, or production bonus subsidy bill.
- A recommendation that prohibitive ad valorem duties be placed on imports of ores and concentrates—possibly on products as well—above set import quotas.
- An invocation to use the so-called Purtell Amendment to the trade act which set up the machinery to translate 1930 specific import duties into current ad valorem percentages.

Whatever the Commission suggests, the burden will then shift to mining-state Congressmen to push for new legislation to aid domestic producers. In a short session, with anticipated White House opposition, chances are regarded as slim for any significant new trade protection.

THE CONGRESS AND SUBSIDIES—Mining experts in Washington are turning once again to the idea of Government incentive purchase programs, production bonus payments, or price support devices as a likely candidate for a new Mining Bloc drive on Capitol Hill.

Congressional committee staffers already are drafting new subsidy legislation along the lines of the two previous legislative proposals backed by Interior Secretary Fred A. Seaton, but rejected in the last two sessions of congress.

Interior Department officials have not yet indicated they will support a third attempt at subsidy legislation, nor has over-all Administration backing been lined up.

However, mining-state Congressmen are firm in their plans to introduce one or more bills along these lines, and will try to line up enough Congressional support to persuade the Administration to go along, if only as a preferable alternative to legislated tariff protection.

MINES PRESERVATION ACT—Leaving no possibilities for new mining support legislation unexplored, the powerful Senate Interior Committee will back another new mineral aid approach. Chairman James Murray (D-Mont.) and other sponsors have introduced a bill to set up a loan fund, administered by the Interior Secretary, to lend maintenance money to distressed mines with a view to keeping them in production until their economic plight improves.

Theoretically, the program would not cost the Government any money, but would sustain itself and its unavoidable losses through interest charges on loans to mines which later would be in a position to pay back the initial outlay. However, an Interior Department appropriation would be required to get such a program going initially.

Romney and Others Seek Import Quota Raises

ALL SHADES of opinion were read into the Tariff Commission record last month at hearings on what—if anything—the Government should do to provide domestic lead and zinc industries additional protection against the inroads of foreign import competition.

There were nearly 40 witnesses, and almost as many solutions proposed. The hearing testimony will serve as a partial basis on which the Commission will report its "specific findings of fact" to Congress (See Highlights, this page).

The Mining Bloc in Congress presented a united front in favor of broad but unspecified additional curbs on imports of ores and concentrates and products. Leading off were Senate Interior Committee chairman James Murray (D-Mont.) and ranking Republican Henry Dworshak (R-Idaho). They were followed by:

Senators Wallace Bennett (R-Utah), Frank Moss (D-Utah), Alexander Wiley (R-Wis.), and Robert Kerr (D-Okla.); Representatives Ed Edmondson (D-Okla.), Denver Hargis (D-Kan.), and Gracie Pfost (D-Idaho).

The domestic producers' case was carried by its Emergency Lead-Zinc Committee, headed by chairman Miles Romney. Romney endorsed pending legislation on Capitol Hill which put a 4¢ per lb import duty on lead and zinc metal, a 2.8¢ tariff on metal content of ores and concentrates, and varying rates hikes on manufactured products. These rate increases would be automatically suspended when domestic prices of lead topped 15½¢ per lb and zinc 13½¢. Romney also backed a flexible import quota proposal tied to the same prices.

Four lead-zinc product manufacturers urged protection against competing imports of semi-finished and finished forms. American Zinc, Lead & Smelting Co. vice-president Richard Young testified for a 2.1¢ per lb specific duty on zinc metal.

Opponents of any new trade restrictions, some of whom urged removal of existing import quotas, included international producers such as Cerro de Pasco Corp. president Robert Koenig, and spokesman for Mexican and Canadian firms. Domestic smelters testified against continuation of quotas, but some favored tariff increases raising levels to as much as 2⅛¢ on lead metal and 2½¢ on zinc. Others urged that no tariff hikes be imposed.

Smelter and processor witnesses included American Smelting & Refining Co. vice-president Simon Strauss, American Diecasting Institute, Inc., secretary David Laine, American Metal Climax, Inc.'s John Lennon, Matthiesen & Hegeler Zinc Co.'s Herman Carus, Athletic Mining and Smelting Co.'s Raymond Orr, and National Zinc Co.'s Frederick Jeffrey.

Eisenhower Budget Cuts Stockpile Expenditures

THE PRESIDENT'S 1960-61 budget once

again underscores the fact that Government spending on domestic mining programs will be directed at research and development activities rather than stockpiling.

Current stockpiling costs, including settlement of contracts already obligated, however, will run $134-million, down from $230-million in the past fiscal year.

The Bureau of Mines' $30-million budget includes $21.7-million for conservation and development programs, including $3.7-million for ferrous metals, $5.3-million for nonferrous metals, and $2.1- million for non-metallic minerals.

The Geologic Survey's funds include $26.6-million for mineral resources surveys.

BDSA Forecasts Metals Use: Sees Increases

ANNUAL FORECASTS are rolling off Commerce Department's BDSA presses again, and the metals outlook as tabulated so far is more bullish than usual.

Here are BDSA's capsulized predictions for 1960:

Lead—Demand will rise 3.5% over a 1959 estimate of 1.1-million short tons, based on "modest" increases in requirements for automobiles, storage batteries, tetraethyl lead, pigments and solder.

Zinc—Consumption up 15-17% over last year's 940,000 short tons, accounted for largely by galvanized steel mill products, particularly sheet and strip.

Copper—Shipments of copper-base mill and foundry products up "as much as 5%." Impact of the strike will continue for months after production is resumed, but within six months refined copper supply "is expected to be more than ample for all requirements."

Aluminum—Producers' shipments to consumers up 10-15% over last year's 4.9-billion lb when production neared 2-million tons. Automobiles, construction, defense projects, consumer goods all will require more aluminum.

Nickel — Consumption will exceed 1959's by about 15%, may reach 255-million lb steel and automobile production will account for much of the increase.

Magnesium—Consumption up 10-15% despite a drop in aircraft output.

Columbium-Tantalum—Tantalum production will rise "substantially," Columbium demand will enjoy "a further rise."

Titanium—Mill product output down 800,000 lb to 5.2-million lb. Sponge production will be geared to "current usage only" and decline accordingly. Use will decline 10-15%.

Iron Ore—Great Lakes shipping interruptions this winter may cause shortages locally, but imports will rise from last year's estimate of over 30-million gross tons. Steel exports, however will increase, and imports decline.

Ferroalloys—Output will continue rising to 2.7-million tons, breaking the previous record by 2%.

Mining Machinery—Shipments up 12-15% over 1959.

Labor This Month

LABOR SHUNS CONGRESS BATTLE: It's "wait till next year" for the next union campaign to overhaul the key labor laws—Taft-Hartley and the Landrum-Griffin reform measure. AFL-CIO political strategists have quieted the union cry to revise the measures. Says federation president George Meany, flatly: "We can expect no constructive improvements in labor-management legislation from the 86th Congress." It was this Congress, last session, that voted the new reform act over labor's violent objections. Union leaders don't want to risk the gamble of another losing contest.

WELFARE—THE UNION POLITICAL CRY: When it comes to organized labor's legislative campaign this session, the target is general social legislation. "On the side of the angels," is the way United Auto Workers' president Walter Reuther puts it. A seven-point AFL-CIO program runs the gamut from national defense to civil rights.

In between are these legislative goals: A $1.25 minimum wage, with retail and service employes to be brought under the Federal wage umbrella, adding medical payments to Social Security benefits; Federal aid to chronically depressed areas; housing, education and civil rights measures.

BIG STRIKES — LITTLE ACTION: Settlement of the steel dispute quickly cooled off Congressional fervor for a new solution to national emergency strikes. Ideas still abound among key Congressmen, but for all practical purposes the subject is now moot—until the next time. Instead, labor-relations experts are banking on the severity of the 1959 steel strike to inhibit labor and management from repeating a major contest soon again.

This applies to not only steel, but the copper and railroad industries as well. Threats of a nationwide rail walkout in current bargaining are now considered unlikely. Though the carrier and union negotiators are far from agreement, a peaceful way out is anticipated.

TEAMSTERS BACK MINE-MILL OATH FIGHT: Surprise backing by James R. Hoffa's Teamsters is helping the Mine-Mill and Smelter Workers to carry on its current court fight against the Government. Mine-Mill lost the first round in Federal court with the conviction of nine current and former officers on charges of making false Taft-Hartley oaths. Specifically, they are accused of lying about alleged Communist connections back in 1949.

With the decision of Mine-Mill officials to carry out the full legal appeal, Hoffa advised Mine-Mill president John Clark that the trucking union plans to "assist financially . . . to reverse these conditions through appeal." Hoffa's pledge, made in a letter, did not specify the sum that would be offered.

HOFFA'S SHOWDOWN BATTLE ARRIVES: After almost three years of legal sparrings, Teamster president Hoffa faces his own big legal challenge. He goes on trial this month for allegedly violating his trust as provisional president of the International Brotherhood of Teamsters. Hoffa serves in the top job under a court order that set up a board of monitors to oversee his stewardship. It's the monitors who now seek to depose the labor leader. They accuse him of misuse of truck union funds, along with a score of other charges. This is the most critical test faced so far by the 48-year-old Detroit labor leader, who was also a target of the McClellan Committee.

LABOR-MANAGEMENT RULES CHALLENGED: The National Labor Relations Board, which applies Taft-Hartley's rules for union-employer behavior, is unhappy with its own operations. A special NLRB committee, after a year's study, wants to overhaul the procedures by which unions and employers file unfair labor practice charges against each other. Main complaint: It usually takes more than a year to process each case.

Among the proposed solutions: Cut down the time spent on appeals of trials decisions. Both labor and management are contesting the initial decisions, more and more, and such appeals must be acted on by the full five-man board. The plan: To bar some appeals, and restrict others that reach the board.

MARKETS

Kennecott Utah Strike Ends. Zinc Prices Confused. Lead Sales Heavy

PRICES OF NONFERROUS METALS in January 1960 eased slightly. The E&MJ index was 127.8% of the 1947—'49 average; December was 128.1%. Major effect came from the drop in lead to 12¢ from 12.523¢ in December. Copper was off slightly also: it dropped from 33.-724¢ to 33.654¢ a lb. These were partly offset by the increase in zinc to 12.877¢ from 12.5¢ and aluminum to 28.1¢ from 27.255¢.

Kennecott and the last of the striking unions finally settled. A number of craft unions had remained on strike for about two months after the first settlement at its striking U.S. properties. The Utah mine was struck for about 170 days. The final agreement was made January 27. The unions got about the same as those that settled earlier—22.3¢ per hour. The agreement expires July 1, 1961.

Three union groups had held out at the Kennecott Utah Division: the Brotherhood of Locomotive Firemen and Enginemen, the International Association of Machinists and the System Federation Union.

Kennecott has some refined copper ready for shipment from its Utah refinery. It has cleaned out its tank house and it will be about 14 days after new copper is put in before cathodes can be pulled. It has anodes and starting sheets so that it can put copper into the tanks without delay. Casting will only take a day or two. There will be a period in which it will not be shipping copper but by mid-February its copper is likely to be moving. Before the strike Kennecott's Garfield refinery was turning out about 17,000 tons per month.

Prices eased somewhat following announcement of the Kennecott agreement with the unions. London prompt bid, the morning of January 28, before news was received of the settlement, was £272(34¢). The following morning it dropped to £261½. The fall off was the natural reaction to the news. But the following day, February 1, London moved up—it was £266 for the official call. The pick up was mainly the influx of shorts who had to cover sales they had made earlier.

Copper will remain short. But many factors have been surprised at the ability of fabricators to continue to operate after the major strikes had lasted for so many months. Some feel that with all firms operating at full speed except Phelps Dodge and some of Anaconda's facilities the edge will be taken off the copper shortage. Though the strikes have presented the U.S. Government with the opportunity to sell some of the 136,000 short tons it has available in its inventory, there is considerable doubt it will. It cannot sell during a strike and some properties are still out. With settlements not coming all at once there may be enough copper coming out to remove the shortage before the last strike is settled. If all copper properties were in production most factors believe output would exceed consumption. This could lead to opposition among Congressmen to sale of Government copper.

Copper output in the U.S. in December was little changed from the preceding three months. Crude mine output was 23,250 tons and refined output was 46,302 tons according to Copper Institute data. Shipments to U.S. fabricators were 90,123 tons and stocks of U.S. refined copper, including that in Commodity Exchange warehouses, dropped about 10,000 tons to 64,763.

World crude output was 211,222 short tons and refined output was 203,614 tons. Refined stocks dropped 18,043 tons; blister stocks rose 17,375 tons.

Zinc was very firm as January ended. But the month had been one of the most confusing in the history of the industry. On January 8 a major producer boosted the premium on Special High ¼¢ to 1¾¢ delivered over the Prime Western; High Grade was boosted ¼¢ to 1½¢. Other sellers raised by the same amount —except Asarco. It kept the lower premiums but boosted the base price from 12½¢ to 13¢ East St. Louis. Other sellers then moved up to 13¢.

The moves reflect the strength of the zinc market. Even abroad it has been so strong that a considerable amount has been exported (doubtless metal refined here from foreign ores). It is mainly Special High that was strong and based on this the price of Special High could (should) rise. But there has been some belief that the spread between Special and Prime Western is unjustified. Some point out that for some producers there is no greater cost for the one than the other. And where the metal does have to be upgraded some say the cost is much below 1¾¢.

Asarco was expected to raise its premiums. But there was much debate in the trade about the company's motives. And when it did move there was much surprise. About the 24th of January it said it was raising the premiums by ¼¢—but they would not be effective for shipments before April 1. A few days later American Zinc announced it was reducing its premiums ¼¢ for shipments made before April 1. But perhaps most surprising was its decision to give ¼¢ credit on shipments made on the higher basis.

Within a few days the other sellers had dropped the premiums by ¼¢. Some are giving ¼¢ credit on sales made at the higher premiums when shipped before April 1. All sellers will be at the higher premiums for shipments after March 30.

Some factors claim the peculiar price moves reflect the changing conditions of the U.S. zinc industry. A number of zinc refining companies have been moving into the production of zinc die-casting alloys. There is some feeling integration will permit the marketing of the alloys at lower prices and that this will inhibit the displacement of zinc by competing materials. Some point out a number of facts that are in opposition to this view, including the raising of alloy prices (January 26) before the rise in SHG zinc.

Asarco said it will upgrade about 900 tons of zinc a month at its Amarillo plant to Special High—it had been producing only Prime Western there. Anaconda's Montana plant is operating at high rate but only for toll accounts.

Lead sales the first two weeks of January were exceptionally high. Total sales reported to E&MJ METAL AND MINERAL MARKETS were 67,552 short tons for the two weeks. The preceding four months sales had been very low. The last time sales were heavy was in August—the heavy sales then preceded the 1¢ boost in the price. This had been related to the notion that labor strikes might cause a shortage. The January sales boost was partly a move to replenish inventories. Most seem to feel the price could not drop and just might rise—they can't go wrong by buying now, they felt.

Twenty-four countries were represented at the UN sponsored meetings that began January 27 in Geneva to discuss the lead and zinc situation. They decided lead output restrictions should continue, but those on zinc should be removed.

Hearings before the U.S. Tariff Commission on lead and zinc were not greatly different from those held in past years. Each side took a position reflecting its particular interests. The Commission could do (or suggest) almost anything though chances of reducing impediments to imports are almost nil. But some factors would say if the quotas are removed, no matter what happened to import tariffs it would amount to easing import restrictions.

Quicksilver prices remained constant through the month. There are reports output has been rather heavy in the U.S. in recent months.

Aluminum markets are showing no sign of weakening or strengthening. Following the December price increases there was some discussion of further price uses. Aluminum products sold by the primary producers rose. But the increases were not all by the same amount as for pig and ingot. And some prices even fell.

Average Prices January *(E&MJ Quotations)*

Cents per lb unless otherwise indicated:

Copper:	
Electro, domestic refinery	35.654
Electrolytic, export refinery	31.555
Electrolytic, c.i.f. Cont'l ports	32.500
Lead:	
Common, New York	12.000
Common, St. Louis	11.800
Silver:	
Silver, New York, per oz	91.375
Silver, London, pence per oz	79.938
Zinc:	
Prime, Western, East St. Louis	12.877
Prime, Western, delivered (g)	13.377
Tin:	
New York Straits	99.888
Gold, per oz, U.S. price	$35.000
Sterling, Exchange	279.976
Quicksilver, per flask	211.000
Antimony, (E&MJ) (d)	32.590
Antimony, bulk, Laredo	29.000
Antimony, in cases, Laredo	29.500
Antimony for 99½%	24.631
Platinum, refined, per oz	78.750
Cadmium (a)	138.500
Cadmium (b)	148.500
Al, 99½% dom., ingot	28.100
export, pig	23.250
Magnesium, ingot	35.250
Nickel (f)	74.000
Bismuth	$2.250
Cobalt	$1.750

Domestic quotations, unless otherwise stated are in cents per lb. Sterling exchange checks, in cents. Quicksilver per flask of 76 lb.
(a) Per lb delivered, ton lots.
(b) Per lb delivered, small lots.
(d) Domestic 5 tons or more but less than carload lots, packed in case f.o.b New York.
(f) Contract price, f.o.b. Port Colborne U.S. duty included.
(g) Delivered where freight exceeds 0.5c.

Custom Smelter Copper

BASED ON flat price and E&MJ average prices sales in U.S. for month of January reported by American Smelting & Refining Co. electrolytic copper in standard shapes, adjusted to nearest ⅛c; ¼c deducted for selling common.

Delivered consumer's plant	34.875 lb
F. o. b. refinery	34.475 lb

Free Gold Market

INTERNATIONAL gold sales rose 14% in January. Bar prices increased slightly in continental centers while activity in coins also rose. European trading was brisk with Paris leading in volume. Average daily dealings jumped to 3,000,000 after the Algerian crisis. Other centers also reported more active trading. No Soviet gold sales have been reported. Asiatic markets showed continued heavy dealings in India and Indonesia on recurrent currency weakness. Pick's World Currency Report quotes on "free gold" per fine oz as follows:

	Coins		Bars (12.5 kg)	
	Dec. 31	Jan. 31	Dec. 31	Jan. 31
New York transit	.....	.....	$35.08½	$35.08½
Manila	$40.25	$40.25	35.80	35.75
Hong Kong	47.10	47.15	38.60	38.90
Bombay	49.00	52.00	48.75	51.50
Tangier	38.50	38.25	35.10	35.05
Beirut	39.80	40.40	35.18½	35.18½
Paris	39.90	39.75	35.55	35.60
Buenos Aires	40.00	40.35	35.80	35.95

Note: Prices are quoted at the free or black market value of the U. S. dollar in the local markets.

Major Metals

U.S. DAILY AND AVERAGE PRICES

Cents per lb unless otherwise indicated:

Jan. 1960	Electrolytic Copper (a) Domestic	(b) Export	Europe c.i.f. (c)	Lead New York	Lead St. Louis	Zinc (f) Delivered	Zinc East St. Louis	Aluminum Primary Pig 99% U. S. Dest.	Straits Tin New York
1				Holiday					
4	33.875	30.925	31.870	12.000	11.800	13.000	12.500	26.000	99.250
5	34.175	31.000	31.945	12.000	11.800	13.000	12.500	26.000	99.500
6	33.600	31.075	32.020	12.000	11.800	13.000	12.500	26.000	99.250
7	33.500	30.875	31.820	12.000	11.800	13.000	12.500	26.000	99.250
8	33.700	30.700	31.645	12.000	11.800	13.032	12.532	26.000	99.375
11	33.925	30.825	31.770	12.000	11.800	13.500	13.000	26.000	99.375
12	33.600	31.000	31.945	12.000	11.800	13.500	13.000	26.000	99.375
13	33.450	31.100	32.045	12.000	11.800	13.500	13.000	26.000	99.500
14	33.550	31.300	32.245	12.000	11.800	13.500	13.000	26.000	99.500
15	33.450	31.725	32.670	12.000	11.800	13.500	13.000	26.000	99.625
18	33.250	31.325	32.270	12.000	11.800	13.500	13.000	26.000	100.000
19	33.525	31.350	32.295	12.000	11.800	13.500	13.000	26.000	100.250
20	33.225	31.700	32.645	12.000	11.800	13.500	13.000	26.000	100.375
21	33.800	31.950	32.895	12.000	11.800	13.500	13.000	26.000	100.500
22	33.875	31.775	32.720	12.000	11.800	13.500	13.000	26.000	100.500
25	33.750	31.925	32.870	12.000	11.800	13.500	13.000	26.000	100.500
26	33.875	32.375	33.320	12.000	11.800	13.500	13.000	26.000	100.500
27	33.775	32.950	33.895	12.000	11.800	13.500	13.000	26.000	100.375
28	33.600	32.850	33.795	12.000	11.800	13.500	13.000	26.000	100.375
29	33.575	32.375	33.330	12.000	11.800	13.500	13.000	26.000	100.375
AVERAGES FOR MONTH									
Jan.	33.654	31.555	32.500	12.000	11.800	13.377	12.877	26.000	99.888
AVERAGES FOR WEEK									
Jan.									
6	33.713	31.056	32.001	12.000	11.800	13.000	12.500	26.000	99.219
13	33.635	30.900	31.845	12.000	11.800	13.306	12.806	26.000	99.375
20	33.400	31.480	32.425	12.000	11.800	13.500	13.000	26.000	99.950
27	33.815	32.195	33.140	12.000	11.800	13.500	13.000	26.000	100.475
CALENDAR WEEK AVERAGES									
Jan.									
1	33.744	31.500	32.445	12.000	11.800	13.000	12.500	26.000	98.688
8	33.770	30.915	31.860	12.000	11.800	13.006	12.506	26.000	99.325
15	33.595	31.190	32.135	12.000	11.800	13.500	13.000	26.000	99.475
22	33.535	31.620	32.565	12.000	11.800	13.500	13.000	26.000	100.325
29	33.715	32.495	33.440	12.000	11.800	13.500	13.000	26.000	100.425

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered U. S. basis add 0.400c per pound, the average differential for delivery charges.

(b) Export copper daily quotations are weighted averages based on sales outside the U.S. reported to E&MJ. Ocean freight and 0.125c lighterage and handling are deducted to arrive at the f.o.b. Atlantic seaboard refinery quotation. On f.a.s. U.S. sales lighterage of 0.125c is deducted.

(c) The c.i.f. Continental ports quotation is arrived at by adding to the f.o.b. export quotation lighterage, and the standard conference freight and insurance, Atlantic ports to main Continental ports. Currently this is 0.125c and 0.82c.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingots; cathodes are sold at a discount of 0.125c to 0.15c per pound. Quotations for zinc are based on Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East, Middle West, and West effective Jan. 8, 1960, commanded a premium of 1.25-1.50c per pound over the current market for Prime Western: Special High Grade 1.50-1.75c effective Jan. 8, 1960.

(f) Prime Western delivered where freight from E. St. Louis exceeds 0.500c.

Quotations for lead are based on domestic common lead. Corroding lead commands a premium of 10 points (almost all U. S. lead is corroding grade).

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

Jan. 1960	Silver (c) New York	Silver London	Sterling Exchange	Gold (d) London
1	Holiday			
4	91.375	80.250d.	280.0700	250s. 4d.
5	91.375	80.250d.	279.9120	250s. 6½d.
6	91.375	80.250d.	279.8860	250s. 7½d.
7	91.375	80.250d.	279.9040	250s. 7d.
8	91.375	80.250d.	279.8700	250s. 7½d.
11	91.375	80.250d.	279.8460	250s. 7½d.
12	91.375	80.250d.	279.8060	250s. 8d.
13	91.375	80.250d.	279.8080	250s. 8½d.
14	91.375	80.250d.	279.8125	250s. 8¾d.
15	91.375	80.000d.	279.8320	250s. 9d.
18	91.375	80.000d.	279.8140	250s. 9½d.
19	91.375	79.750d.	279.8120	250s. 9¾d.
20	91.375	79.750d.	279.8600	250s. 9¾d.
21	91.375	79.750d.	280.1880	250s. 9½d.
22	91.375	79.750d.	280.1940	250s. 8d.
25	91.375	79.500d.	280.1420	250s. 5½d.
26	91.375	79.500d.	280.1100	250s. 7d.
27	91.375	79.500d.	280.1640	250s. 7½d.
28	91.375	79.500d.	280.2580	250s. 6½d.
29	91.375	79.500d.	280.2300	250s. 6½d.
AVERAGES FOR MONTH				
Jan.	91.375	79.938d.	279.976	—
AVERAGES FOR WEEK				
Jan.				
6	91.375	—	279.955	—
13	91.375	—	279.847	—
20	91.375	—	279.826	—
27	91.375	—	280.160	—

Calendar Week Averages: New York Silver: Jan. 8, 91.375; Jan. 15, 91.375; Jan. 22, 91.375; Jan. 29, 91.375.

(c) The daily silver quotations reported by Handy & Harman, in cents and fractions of a cent per troy ounce, is the price paid by Handy & Harman in settlement for silver contained in unrefined silver-bearing materials submitted to them for refining. It is determined on the basis of offers of bar silver .999 fine as made to Handy & Harman for nearby delivery at New York by regular supplies in quantities sufficient to meet daily requirements, and it is usually 0.250c below the price of which such offers are made.

The Treasury's purchase price of newly mined domestic silver is 90.5c per troy ounce 1000 fine effective July 1, 1946. London silver in pence per troy ounce, basis 999 fine.

(d) U. S. Treasury's gold price is $35. Actual payment by the United States Treasury for gold is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

MARKETS (*Continued*)

London Metal Exchange Quotations

Jan.	Copper Cash Bid	Copper Cash Asked	Copper 3 Mon. Bid	Copper 3 Mon. Asked	Lead Current Month Bid	Lead Current Month Asked	Lead 3 Mon. Bid	Lead 3 Mon. Ask	Zinc Current Month Bid	Zinc Current Month Asked	Zinc 3 Mon. Bid	Zinc 3 Mon. Asked	Tin Cash Bid	Tin Cash Asked	Tin 3 Mon. Bid	Tin 3 Mon. Asked
1							Holiday									
4	253	253½	239	239½	74½	74¾	73⅝	73⅞	94½	94¾	89½	89¾	785½	786	782	782½
5	254½	255	241½	242	75	75⅛	74	74⅛	95⅛	95⅜	90⅛	90⅜	790½	791	785½	786
6	254	254½	242⅛	242½	74⅝	74⅞	73⅝	73⅞	95⅛	95⅝	90½	90⅝	788½	789	784½	785
7	253½	254	243½	243⅝	74⅛	74⅜	73⅞	74	95⅛	95⅜	90½	90¾	793½	794	785	785½
8	250	251	242½	242¾	74⅜	75	74⅛	74¼	95¼	95½	90⅜	90½	789	790	787	788
11	253¾	254	244¾	245	75½	75⅝	74⅜	75	95¼	95½	91	91½	788	789	786½	787
12	256½	257½	246	246½	75½	75⅝	75⅛	75¼	95⅝	95¾	92¼	92½	789½	790	786½	787
13	255½	256	245	245½	75	75⅛	74¾	74⅞	94¾	95	91½	91¾	789½	790	786½	787
14	255½	256½	245	245⅛	74¾	75	74⅜	74⅞	94¾	95	92	92¼	790½	791	787½	788
15	258¾	259	246¼	246½	75	75⅛	74⅜	74⅞	95½	95⅝	92¼	92⅝	790½	791	787½	788
18	260	260½	247½	248	75	75½	74⅞	75	95⅝	95½	92½	92⅝	793	793½	789½	790
19	256½	257	245⅝	246	74⅛	74⅝	74⅜	74⅞	94	94¼	91⅜	92	793½	794	789	789½
20	259	259½	246¼	246½	74¾	74⅞	74⅝	74¾	93¾	93⅞	91¾	92	795	796	790	790½
21	260½	261	246½	247	74⅛	74⅜	74¼	74⅝	93¾	94	92	92¼	792½	793	790	790½
22	261	262	247⅝	248	73⅞	74	74	74½	93⅝	94	92⅛	92¾	791½	792	788½	789½
25	264	264½	248¾	249	73⅝	74	74	74½	93¼	93½	92¾	92½	789½	790	787	787½
26	268	269	251	251½	74½	74¾	74⅜	74½	93½	93¾	92¾	92½	791	793	788½	789½
27	271	272	253¾	254	74⅝	74⅞	74⅝	75	93¼	93⅝	92¼	92⅝	793	793½	788	788½
28	272	273	254½	255	75	75½	75½	75¾	93½	94	92¾	92½	794	794½	788	788½
29	261½	262½	247½	248	74¾	74⅞	74⅞	75	93½	93¾	92¼	92½	793	793½	788	789
Av'g's	£259.263		£246.438		£74.781		£74.525		£94.572		£91.747		£791.375		£787.550	

Prices are for the official a.m. session in pounds sterling per ton of 2240 lb. Copper basis wire bars, lead 99.9%, zinc 98% and tin min. 99.75%.

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipments, f.o.b. New York unless otherwise stated, tons of 2,000 lb unless otherwise noted. st—short ton; lt—long ton; stu—short ton unit; ltu—long ton unit. (p) duty paid.

MISCELLANEOUS METALS

Jan. 31, 1960

Aluminum ingot, 99 plus % lb		28.1c
Antimony, spot, lb, less than carload, in cases		32.59c
In bulk, carload lots, f.o.b. Laredo		29.00c
Imported. 10 ton min. (p), 99½%	24¾ —	25c
Bismuth, ton lots, lb		$2.25
Cadmium,ton lots delivered, lb		$1.40
small lots		$1.50
Calcium, lb, ton lots, 98%, cast		$2.05
Chromium, 97% grade, lb, contract delivered		$1.29
Cobalt, 97 to 99%, per lb effective Feb. 1, 1957		$1.75
Germanium, per gram, 10,000 gram lots	(d)$28.15c—(c)(d)	$29.95c
Indium, troy oz	$1.25 —	$2.25
Lithium, lb, 98%	$9.00 —	$11.00
Nickel, cathodes, lb (a)		74c
Other sales, regular sellers		74c
Sales by dealers, etc.		74c
Magnesium, 99.8% carloads, lb producer's plants, Velasco, Texas, effective Apr. 16		35c
Palladium, troy oz	$24 —	$26
Platinum, troy oz	$82 —	$85
Quicksilver, flask of 76 lb, 25 flasks or more	$211 —	$213
Selenium, 99 plus %, lb—(Feb. 19, 1958)		$7.00
Silicon, minimum 98%, carloads, lb		19c
Semi Conductor grade, lb		$360
Tellurium, lb		$2.50
Thallium, 100 lb or more		$7.50
Titanium, 99.3% plus, grade A-1, max. 3% Fe, lb (b)	$1.50 —	$1.60

(a) Effective Dec. 6, 1956; including U.S. duty; (b) Effective Aug. 1, 1959. (c) Delivered; (d) f.o.b. plant.

METALLIC ORES

Beryllium ore, imported, 10% BeO, (b) stu: spot		$31.75–32.50
term contracts		$34–34.50
Chrome ore per long ton, f.o.b cars Atlantic ports, dry: 44% Cr_2O_3 no ratio	$18.75 —	$19.00
48% Cr_2O_3 3 to 1 ratio	$34 —	$37
Iron ore, Lake Superior, Lower Lake ports, lt		
Old Range bessemer		$11.85(e)
Mesabi bessemer		$11.60(e)
Mesabi non bessemer		$11.45(e)
Lead (Galena), 80%, Joplin, Mo., ton		$141.72
Manganese ore—Per ltu of Mn basis 48%, nearby positions, subject to premiums and penalties, c.l.f. U. S. ports import duty extra., (n)87c—90c. Long-term contract nominal.		
Molybdenum ore, 90%, per lb of Mo f.o.b. mines		$1.25
Columbium-Tantalum, per lb, combined oxides 10 to 1 ratio	$1.18 —	$1.25
Tungsten ore, per stu of WO_3:		
Foreign 60%, c.i.f. U.S. ports, duty extra	$19.50 —	$20.00
U. S. scheelite, f.o.b. mill	$22 —	$24
Vanadium ore, per lb of contained V_2O_5 f.o.b. mines		31c
Zinc ore, Prime, 60% concentrate, Joplin, Mo., per ton.		$80

(a) Nominal. (b) c.i.f. U.S. ports. (e) Effective 1958 shipping season.

METALLIC COMPOUNDS

Arsenous oxide (arsenic trioxide) lb, in bbl, carload lots N. Y. docks		4–5c
Cobalt oxide, 72½% to 73½%, per lb, effective Dec. 1, 1956	$1.33 —	$1.36
Copper sulphate, 100 lb, effective Nov. 6, '59		$13.00
Germanium dioxide, gm		16½c
Molybdic trioxide, technical, per lb of Mo	$1.46 —	$1.47
Imported, including 37c duty	$1.75 —	$2.05

ALLOYS

Ferrochrome 65 to 70%, per lb of Cr, (4-9% C)		28¾c
Ferromanganese, 74 to 76%, per lb shipping point		11c
Ferromolybdenum, 58 to 64% Mo. Lb of Mo contained.	$1.50 —	$1.82
Ferrosilicon, 50% per lb of Si f.o.b. shipping point (3-1957)		14.60c
Ferrotungsten, 72 to 82%, lb of W contained		$2.15
Ferrovanadium, per lb of V delivered	$3.20 —	$3.40
Silicomanganese, max. 1½% c, lb contracts		11.6c
Spiegeleisen, per lt, 19—21% grade effective Jan. 22		$100.00

NONMETALLIC MINERALS

Asbestos, f.o.b. Canada (Quebec) mines (Canadian funds) ton:

Crude No. 1	$1,400–$1,725	Paper Stock	$120–$142
Crude No. 2	$750– $1100	Waste	$75– $86
Spinning Fibers	$350– $565	Shorts	$22– $75
Shingle fibers	$180– $220		

Asbestos, f.o.b., Vancouver, B. C. (Canadian funds):

Crude No. 1	$1,522	Spinning fibers	$220–$787

Asbestos, Vermont, f.o.b. Morrisville:

Spinning fibers	$353– $408	Waste, stucco or plaster	$86
Shingle stock	$181– $218	Refuse or shorts	$41– $75
Paper stock	$120– $142		

Barytes f.o.b. cars:		
Georgia, crude, per ton		$18
Missouri, 94%, $BaSO_4$, per st	$16 —	$18
Crude oil well grade, min. 4.3 sp gr, st (a)		$18
Imported, c.i.f. Gulf Ports, st	$16 —	$18
Bauxite, st, f.o.b. point of shipment:		
Domestic, crude, 50%, 8% Fe, 13% Si	(c)$12.25 —	$13.50
Imported metallurgical, per lt, f.o.b. Br. Guiana, depending on grade		$7.14
Feldspar, bulk ton:		
Potash or soda feldspar, 200 mesh, ceramic grade	$20.50 —	$21
Glass feldspar, white, 20 mesh		$9
Fluorspar, f.o.b. mines, bulk, 72½% effective, ton	$37 —	$41
60% effective CaF_2	$33 —	$36.50
Acid 97% concentrate, bulk, ton		$45.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00 —	$14.00
Magnesite, per ton dead-burned, bulk, f.o.b. Washington		$46

Mica—Domestic, f.o.b. mines. Punch 7c—12c per lb according to size and quality. Sheet clear 1½x2 in, 70c—$1.10; 2x2 in, $1.10 to $1.60; 2x3 in, $1.60—$2.10; 3x3 in, $1.80—$2.30; 3x4 in, $2.00—$2.60; 3x5 in, $2.60—$3.00; 4x6 in, $2.75—$4.00; 6x8 in, $4.00—$8.00. Wet ground, very fine, $140—$155 per ton, Bulk sales, dry ground; $30—$55 per ton. Scrap $20—$30.

Ocher Georgia, ton in sacks	$26.50 —	$32.00
Sulphur, long ton, U. S. producers' posted quotations*		
f.o.b. mines, bright		$23.50
dark		$22.50
f.o.b. vessel, bright		$25.00
U. S. ports, dark		$24.00

*Prices will vary from these depending on the competitive situation; currently U.S. sulphur sells at close to Mexican export prices

Mexican, for use in Mexico, per metric ton, f.o.b. mines, 280 to 395 pesos, depending on location	$22.40 —	$31.60
For export f.o.b. vessel, lt, depending on grade	$20.50 —	$22.00
Talc, f.o.b. works, ton:		
New York, purified	$18.00 —	$20.00
Vermont, extra fine		$12.50
Tripoli, Missouri, ton:		
40-mesh, cream colored		$50.00

(a) Some restricted sales at $11.50, (b) Corrected. (c) Nominal.

IRON AND STEEL

Pig iron, gross ton, basic, Valley furnaces		$66.00
Steel, f.o.b. Pittsburgh, billets, net ton		$80.00
Structural shapes, Pa., Ala., etc., 100 lb	$5.30 —	$5.50

B.F.Goodrich

These B.F.Goodrich tires help haul 200,000 tons of coal a month

THIS unit is one of a fleet that hauls 200,000 tons of coal a month out of a strip mine in Ohio. Ahead is an 8-mile trip to the dump on a road made of shale and crushed rock. Payloads run to 50 tons and over. For this rugged work, the company uses B.F.Goodrich Rock Service tires.

Now you get even longer service from Rock Service tires, thanks to 2 amazing new B.F.Goodrich compounds. Only B.F.Goodrich builds tires that are actually *tailor-made* for your type of work.

For jobs where rock cutting and chipping are problems, B.F.Goodrich developed the Cut Protected compound. For jobs with dangerous heat build-up, B.F.Goodrich developed the new Heat Resistant compound. These new tires, and the regular Rock Service, have the B.F.Goodrich FLEX-RITE NYLON cord body that withstands double the impact of ordinary materials. Result: You get more retreadable tires—more retreads per tire.

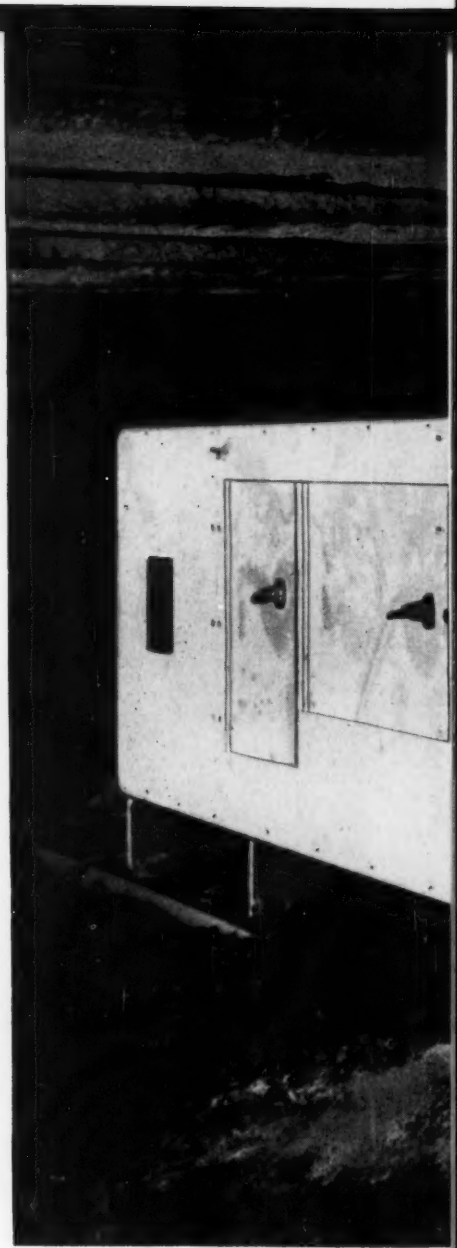
Get the Rock Service tailor-made for you from your B.F.Goodrich Smileage dealer. He's listed under Tires in the Yellow Pages of your phone book. *The B.F.Goodrich Company, Akron 18, Ohio.*

Specify B.F.Goodrich Tubeless or tube-type tires when ordering new equipment

Smileage!

B.F.Goodrich *off-the-road tires*

ONLY WESTINGHOUSE CONSTRUCTION SUITABLE FOR WORLD'S LARGEST SEALED DRY-TYPE MINE POWER CENTER



MINE power center specifications are extremely exacting . . . so exacting that only Westinghouse, the leader in the field, offered a construction found suitable for the world's largest sealed, portable mine power center.

Only Westinghouse construction could combine—in a unit with the desired 600-kva, 7200/480-volt rating—the necessary ruggedness, compact low height and light weight essential to easy portability within mine tunnels.

Here are the key features in this construction:

External ruggedness—A ¼-in. steel plate case protects against roof falls, rough use. A ⅜-in. base plate with ½-in. reinforcing skid runners protects the unit when skidded over rough bottom, haulage tracks, etc., during frequent relocation.

Internal ruggedness—Core and coils braced at both top and bottom to withstand full short circuit conditions, securely mounted in case to withstand moving and rough handling.

Low height—The most compact mine power centers made, the 600-kva unit is only 42 inches high, the 300-kva unit only 36 inches.

Low maintenance cost—Nitrogen-filled, sealed, dry-type power center is practically maintenance-free; protected against moisture even when de-energized during prolonged shutdowns.

This sealed mine power center is but one of the complete line of Westinghouse power centers available to serve the mining industry above the surface, as well as below. Ask your Westinghouse representative about the power center to serve your specific applications.

J-70899

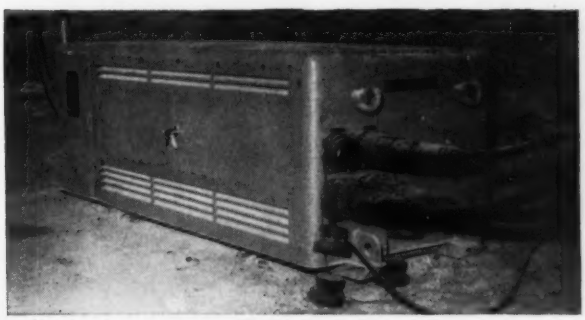
YOU CAN BE SURE...IF IT'S

Westinghouse

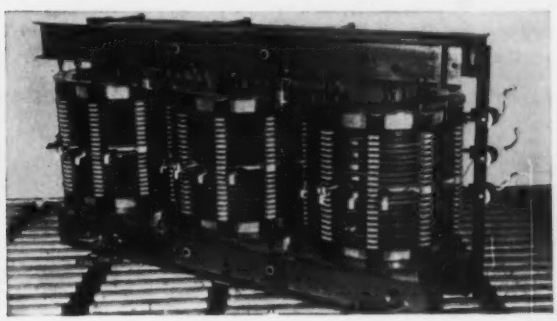
WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV ALTERNATE FRIDAYS

Convenient location of the high-voltage receptacle on world's largest sealed mine power center permits hitching to low-voltage end when unit is skidded to a new location. This allows unit to remain energized; high-voltage cable can pull straight without bending, and buggy can obtain its motive power from one of the secondary feeders.

A full range of ratings in ventilated mine power centers is available from Westinghouse for application where conditions are less severe—such as less dust, lower humidity.



Core and coil assembly for 600-kva, 7200/480-volt, 3-phase unit—world's largest sealed mine power center made by Westinghouse.



Where heavyweights move job records prove...
FIRESTONES CARRY MORE YARDS PER DOLLAR!

Get Firestone off-the-highway tires and get set to make more money! From planning stage to the finished project a combination of Firestone tires and Firestone Giant Tire Service adds up to bigger profits every time. Every Firestone off-the-highway tire is built with Firestone Rubber-X, the longest-wearing rubber ever used in Firestone tires. You get Firestone S/F (Shock-Fortified) nylon cord bodies to guard against impact damage. A *Firestone Tire Expert* will help you match tires exactly to the job and will handle all of your tire maintenance problems to turn downtime losses into worktime profits! Call your Firestone Dealer or Store today!

Always specify Firestone Tires when ordering new equipment

Super Rock Grip Wide Base (Nylon)* Super Rock Grip Deep Tread*

Firestone

BETTER RUBBER FROM START TO FINISH

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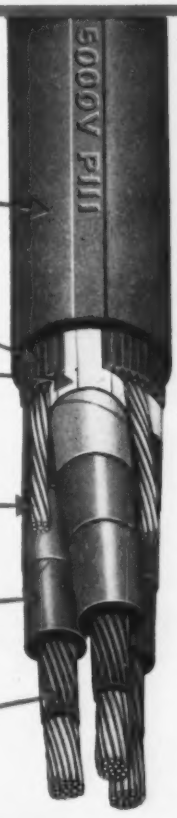
*Firestone T.M.

YOU CAN SEE WHAT MAKES ROEBLING MINE POWER FEEDER CABLE YOUR BEST BUY!



Tough, long-wear Roeprene® sheath wards off moisture, retards flame, resists oil, corrosion, abrasion. Meets flame-resistance requirements of Pennsylvania Dept. of Mines and carries symbol P-111.

All-rubber fillers for moisture resistance, splicing ease.

Tinned-copper shield tape for added safety of operation.

Adequate ground wires, in contact with conductor shielding. Grounds equal more than 90% of circular mil area of single power conductor, for complete grounding and fault return.

Butyl insulation for heat-, moisture-, ozone-resistance. Rated at 90° C copper temperature through 5000 v; 85° C through 15000 v.

Semi-conducting tape around each conductor prevents excessive voltage stress and ionization between conductor and insulation.

These are features that add up to longer, better, more economical service. Even at peak loading, rugged Roebling Mine Power Feeder Cable gives peak performance!

Pride of workmanship, special design features and finest raw materials make the difference. But don't take our word for it. See for yourself. Let us show you samples and give you recommendations and details as they apply to your application. Write to Electrical Wire, John A. Roebling's Sons Division, Trenton 2, New Jersey.

ROEBLING

Branch Offices in Principal Cities
John A. Roebling's Sons Division
The Colorado Fuel and Iron Corporation

Here's another reason why Ford Trucks are your best buy!

"OF ALL THE MAKES WE'VE TRIED FORD TRUCKS GIVE US THE LOWEST MAINTENANCE COST!"

ANOTHER REPEAT BUYER OF FORD TRUCKS

Virgil E. Cook, owner of Cook Block and Brick Co., is convincing proof that there is still plenty of opportunity in American business for those sound planning, hard working individuals who want to own their own business. Starting from scratch just 13 years ago, he now owns and operates one of the largest concrete products plants in Eastern Indiana. The workhorses in his fleet of 16 trucks are three Ford Tilt Cab Tandems that are used to haul sand and gravel to the plant and make deliveries in and around Anderson.

Hard-working Ford CT-950 tractor leaves Cook gravel pit with 18 yards of aggregate. Aluminum walking beam and rubber suspension system of tandem axle assembly reduce chassis weight, permit higher legal payloads.

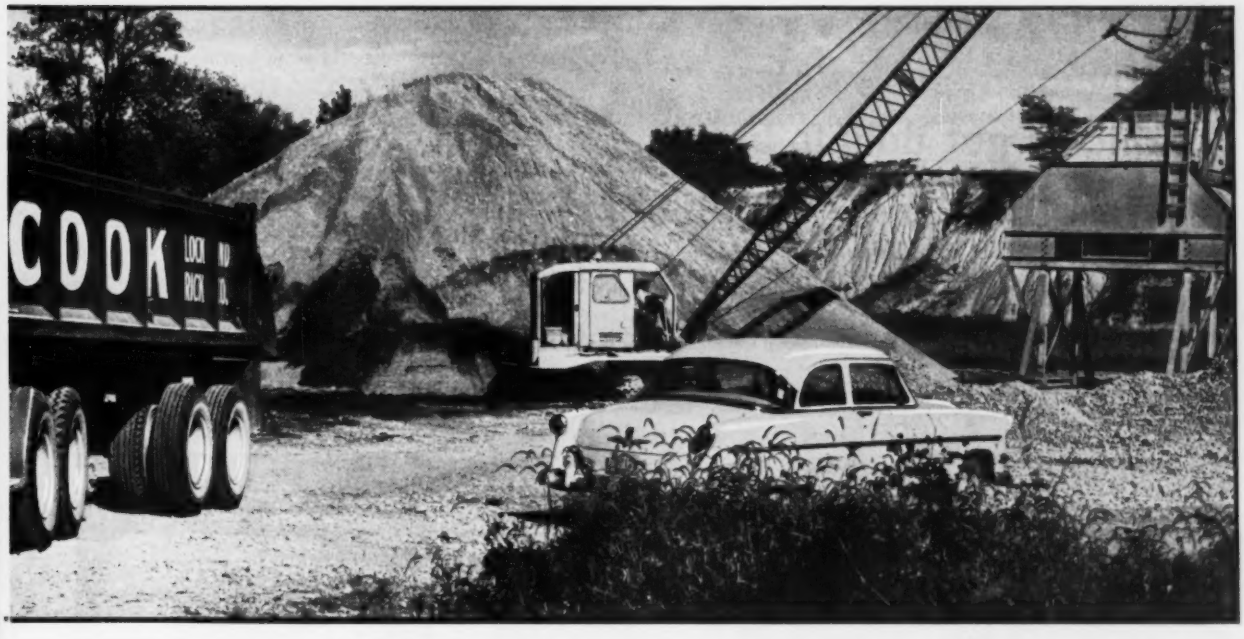
Cook's CT-850 with special flat-bed body and Side-O-Matic unloader delivers blocks right to the job site. Unit carries 600 concrete blocks and spots them where needed.

"Our experience has proved that Ford Trucks can be operated at substantially lower maintenance costs than any other make we've tried. And, equally important in a fleet like ours, we find that our Fords spend much less time in the shop. None of the Ford units purchased since 1958 have been in for major repairs and I am still amazed at the way the older ones keep going.

"The best truck we've ever owned is a 1954 Ford C-700 that consistently carries a load of 350 to 400 blocks over all types of terrain. In spite of this severe work it ran 125,000 miles before we replaced the engine. This unit now has over 140,000 miles on the original ring gear and pinion and it went 60,000 miles before we relined the brakes and put in a new clutch. This is outstanding mileage when you consider that we've realized as little as 12,000 miles from competitive ring gear and pinion sets. Clutch and brake life obtained with other makes in identical service was only 20,000 miles. It's results like this that keep our costs low and convinced us that we should stay with Fords when we bought our bigger trucks in '58.

"Our 1958 and 1959 Ford Tilt Cab Tandems give every indication of equalling or surpassing the fine records set by the C-700. The two CT-950 tractors hauling sand and aggregates to our processing plant breeze through traffic and take the hills like they weren't there at all. Our CT-850 equipped with a flat-bed body has the power and traction to deliver finished products anywhere. With Ford's tilt-cab design we get a real plus as far as payload is concerned because we can carry at least 2,000 pounds more weight on the front axle.

"We buy Ford Tilt Cab Trucks because we think they're the best engineered and most modern gasoline trucks in the heavy-duty field. Here at last is a truck built to permit big legal payloads with enough power to move these loads at economical speeds. We pride ourselves on our modern and efficient equipment and consider our Fords one of the most valuable assets of our business."



'60 Fords are built for longer life . . . with Certified Durability!

Whatever your job . . . wherever you do it . . . you'll discover just as Mr. Cook did, that Ford Trucks are the best investment for your transportation dollar.

Certified results of tests conducted by America's leading independent research organization (name available on request) confirm the fact that Ford Super Duties have been refined for still more durability! Automatic radiator shutters, improved electric fuel pumps and redesigned wiring harnesses are typical of the advancements to be found in these units.

Automatic radiator shutters reduced the coolant temperature variation recorded in severe mountain road tests from a 79° range to a 20° range. Engine operation with coolant temperatures in the 167° to 187° range means less expansion and contraction, more efficient combustion and better lubrication . . . all of which contribute to longer engine life.

Dynamometer tests showed *no vapor lock* with Ford's submerged-type electric fuel pump at temperatures up to 200°. Incipient vapor lock with mechanical fuel pump resulted in a power loss of 9% under the same conditions. Shaker table tests plus constant exposure to oil, water and heat proved 1960 wiring harness to be *three times longer lived.*

FORD TRUCKS COST LESS

LESS TO OWN . . . LESS TO RUN . . . BUILT TO LAST LONGER, TOO!

4-wheel tractor-scraper with Hi-Torque brakes

Heavy rear dump with Hi-Torque brakes

For your heavyweight vehicles get double braking power with Hi-Torque brakes

Operators of heavy off-road vehicles are finding that Hi-Torque brakes boost their profits—and that's a feature to consider when choosing *your* heavy equipment.

Hi-Torque brakes give the "heavyweights" adequate safety and controllability—stop vehicles in approximately half the distance required for conventional two-shoe brakes. With this reserve braking power, cycle time can be reduced as equipment is operated in higher gear. Operators can tackle grades usually considered unsafe, since Hi-Torque brakes don't fade, will stop a fully loaded vehicle downhill!

Specify Hi-Torque brakes on your equipment—ask the vehicle manufacturer for details. Or write *B. F. Goodrich Aviation Products, a division of The B. F. Goodrich Company, Dept. EM-2, Troy, Ohio.*

2-wheel tractor with Hi-Torque brakes

Full circle contact with drum is provided by Hi-Torque brakes giving maximum effective braking surface in the same size unit. Hi-Torque stops vehicles twice as fast as conventional brakes.

B.F.Goodrich

Hi-Torque brakes

AN EDITORIAL REPORT on hauling methods at Anna Quarries, Inc., digested from the September, 1959, issue of "Pit and Quarry" magazine.

Anna Quarries MODERNIZES HAUL FLEET WITH 15-TON DUMPTORS

"Nearly a half century of operation has not lulled the management of Anna Quarries, Inc., Anna, Ill., into a complacent attitude, nor put them in a rut. This 300-t.p.h. plant, one of the largest in southern Illinois has from time to time undergone revision, and it has been equipped with the most efficient operating units available."

Quarry depth: 150 to 175 feet

"Latest step in the continuing improvement program involved quarry and plant feed operations. In view of many years' operation, the quarry is now 150 to 175 ft. deep. Within the last 10 years, the company has acquired a number of 8-ton capacity model 60 Koehring Dumptors." (The Dumptors haul quarry-run stone from shovels to a hopper at intermediate quarry level. From there, a steeply-inclined cableway system carries stone to top of plant.) "Last year, due to further deepening of the quarry, the hopper and cable-way system were moved down another 50 feet."

20% adverse grades

"At that time, experiments were conducted in interest of gaining more haulage capacity. None proved to have the speed and mobility required to negotiate the 20% grades in the confined area, or the limited room for maneuvering at hopper ramp. The latter condition, in particular, focused attention of management on the potential of newer model 100 Koehring Dumptors (15-ton capacity), which, with pivoting seats and dual steering wheels and controls, permits the driver to operate in either direction with ease and speed."

7 Dumptors in quarry fleet

"Two 15-ton units were acquired early in 1959, and put to use in widely separated sections of the operation. One new Dumptor joined the five older, smaller-capacity machines in the quarry, and the other is used at the top for stockpile rehandling. The haulage units transport material up a series of ramps to the hopper, where they discharge via free-fall gravity dump (older machines), or by either free-fall or controlled gravity dump on the newer machine. From the hopper, rock is transferred into cable-cars for transport to top of plant."

P & Q SEPT., 1959

15-TON DUMPTOR facts at a glance:

- **Pivoting seat, 2-way controls**
- **24 mph speed, either direction**
- **constant-mesh transmission**
- **Hydraulic clutches for easy speed-range selection**
- **Torque-converter drive**
- **Power steer; 4-wheel airbrakes**
- **30,000 lb. payload capacity**
- **28½% gradability**
- **Instant, or controlled dump**

How about a Dumptor demonstration on your work? Get in touch with Koehring distributor today — or send coupon for facts-by-mail!

To: Koehring Division, 3026 W. Concordia, Milwaukee 16, Wis.
Send us ☐ *literature* ☐ *specs. on 15-ton 100 Dumptor®*

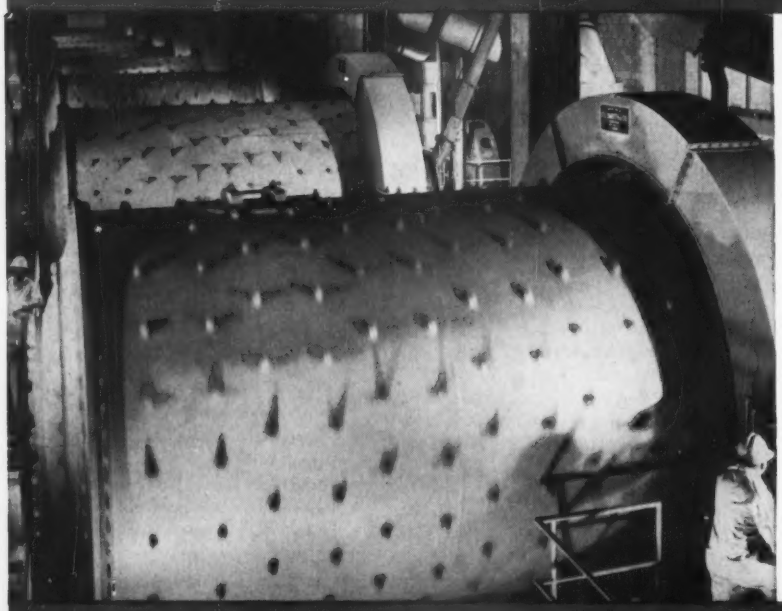
NAME ..... TITLE .....
COMPANY ..... DIV. .....
STREET K20
CITY, STATE ..... EMJ

KOEHRING DIVISION OF KOEHRING COMPANY • Milwaukee 16, Wis.

SMIDTH

rotary kilns

For sintering, nodulizing, calcining, desulphurizing, oxidizing and reducing roasting. Coolers, precoolers, preheaters, recuperators. Auxiliary equipment for Rotary Kiln Plants.



grinding mills

Ball mills, tube mills and multicompartment mills—open or closed circuit—wet or dry grinding. Also airswept for grinding and drying. Over 1250 Smidth Rotary Kilns and over 5000 Grinding Mills supplied all over the world.

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Paris (9e) France

F. L. Smidth & Co. of Canada, Ltd.
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New York 36, N. Y.

F. L. Smidth & Co. (Bombay) Private Ltd.
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Bombay, India

YOU'LL NEVER BURN OUT AN AIR TOOL

with the new Le Roi LO-380 line oiler...

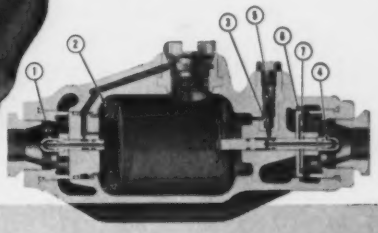
Here's how the LO-380 Saves Tools—Cuts Repairs!

(1) Inlet reed valve meters air into the oil-resistant bellows (2) which creates pressure that forces regulated amount of oil through porting connected to the needle valve (3) and the porting connecting it to the outlet reed valve (4) through which oil is injected into the air stream.

(5) Set screw permits easy external adjustment of oil feed during operation.

(6) Positive pressure differential valve assures correct oil feed for all air flows — eliminates oil waste.

(7) Shut-off valve automatically stops air when oiler is empty. As oil supply goes down, bellows (2) expand and contact the shut-off plunger, depressing it until the valve reaches the automatic shut-off position.



EMPTY OILER SHUTS OFF AIR!

That's right! *You'll never burn out an air tool with the new Le Roi LO-380 on the job!* When the oiler runs dry, it automatically shuts off the air! The "no oil — no air" design prevents unnecessary wear on critical parts — cuts repair bills — extends tool life!

The new line oiler assures positive lubrication for air tools — delivers a steady mist of oil at 10 to 150 psi — and keeps it flowing until you shut the air off, or until the empty oiler shuts it off automatically. Metered oil flow provides exceptional economy, prevents oil splurges. As a matter of fact, the LO-380 will pay for itself in a short time through oil savings alone!

Oiler permits easy external adjustment of oil feed — provides full one-pint capacity. Lightweight—only 9 lbs.—it's easy to use, easy to move—operates in any position. Oiler can be refilled under pressure while air tool is in operation.

Contact your nearest Le Roi distributor for details — or write to Le Roi Division, Westinghouse Air Brake Co., Milwaukee 1, Wisconsin.

LE ROI NEWMATIC® AIR TOOLS

PORTABLE AND TRACTAIR® AIR COMPRESSORS • STATIONARY AIR COMPRESSORS • AIR TOOLS

AT-9266

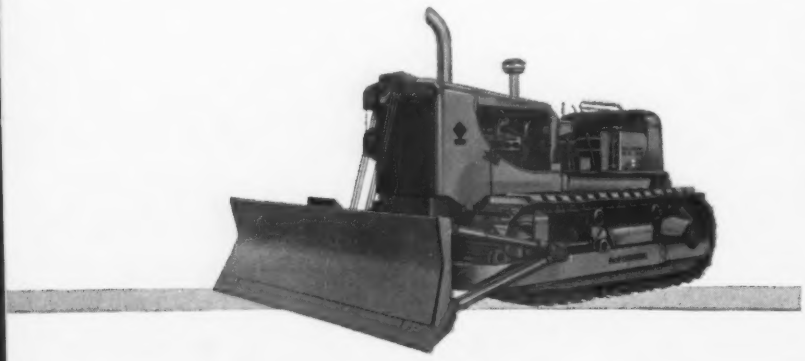
MIGHTY... HEALTHY... POWER

Whether your choice is the 225-hp HD-21 or the 150-hp HD-16, you get from 8½% to 27% more efficient engine operation than from other crawlers.

This fuel-pinching efficiency is a fact! Your Allis-Chalmers dealer will show you actual proof of up to 27% fuel savings in the Allis-Chalmers 16000 or 21000 engines over units of comparable size. He'll tell you why they run cleaner . . . how they "sip" fuel to earn the title "industry's healthiest engines."

Six crater-shaped pistons develop 225 hp in the HD-21, 150 hp in the HD-16 . . . both at an easy 1825 rpm. Coupled with torque converter drive, they provide plenty of rough dozing lugability . . . all the power you'll ever need.

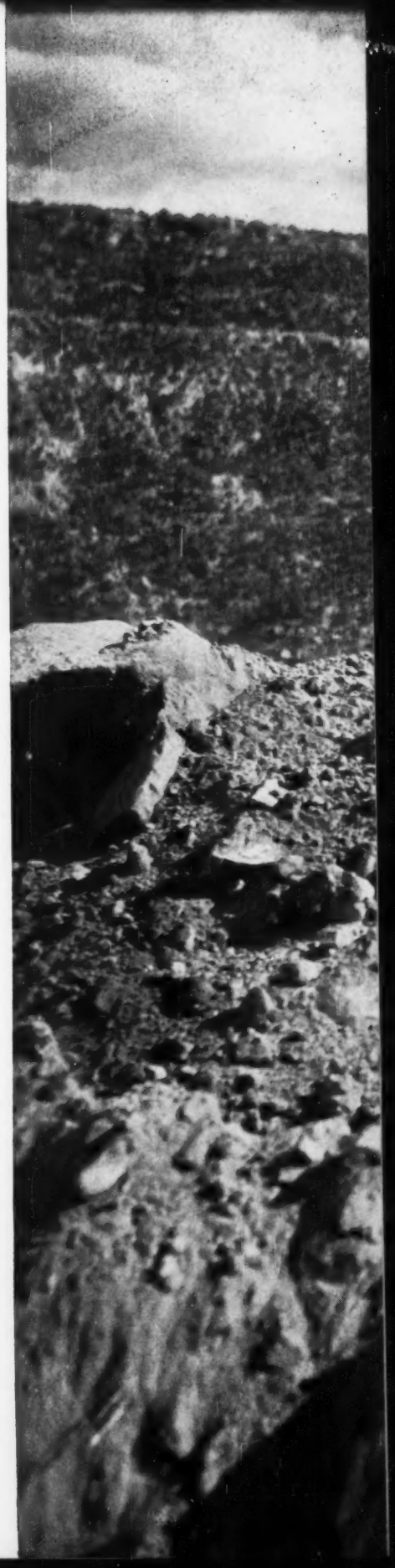
These big Allis-Chalmers tractors are built for mighty tough service. Shock-absorbing all-steel main frame, durable double-reduction final drives, certified permanent lubrication of tapered roller bearing truck wheels, idlers and rollers, and extra tough track keep them going season after season with a minimum of maintenance. Your Allis-Chalmers construction machinery dealer will be glad to show you an HD-21 or HD-16 soon. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.



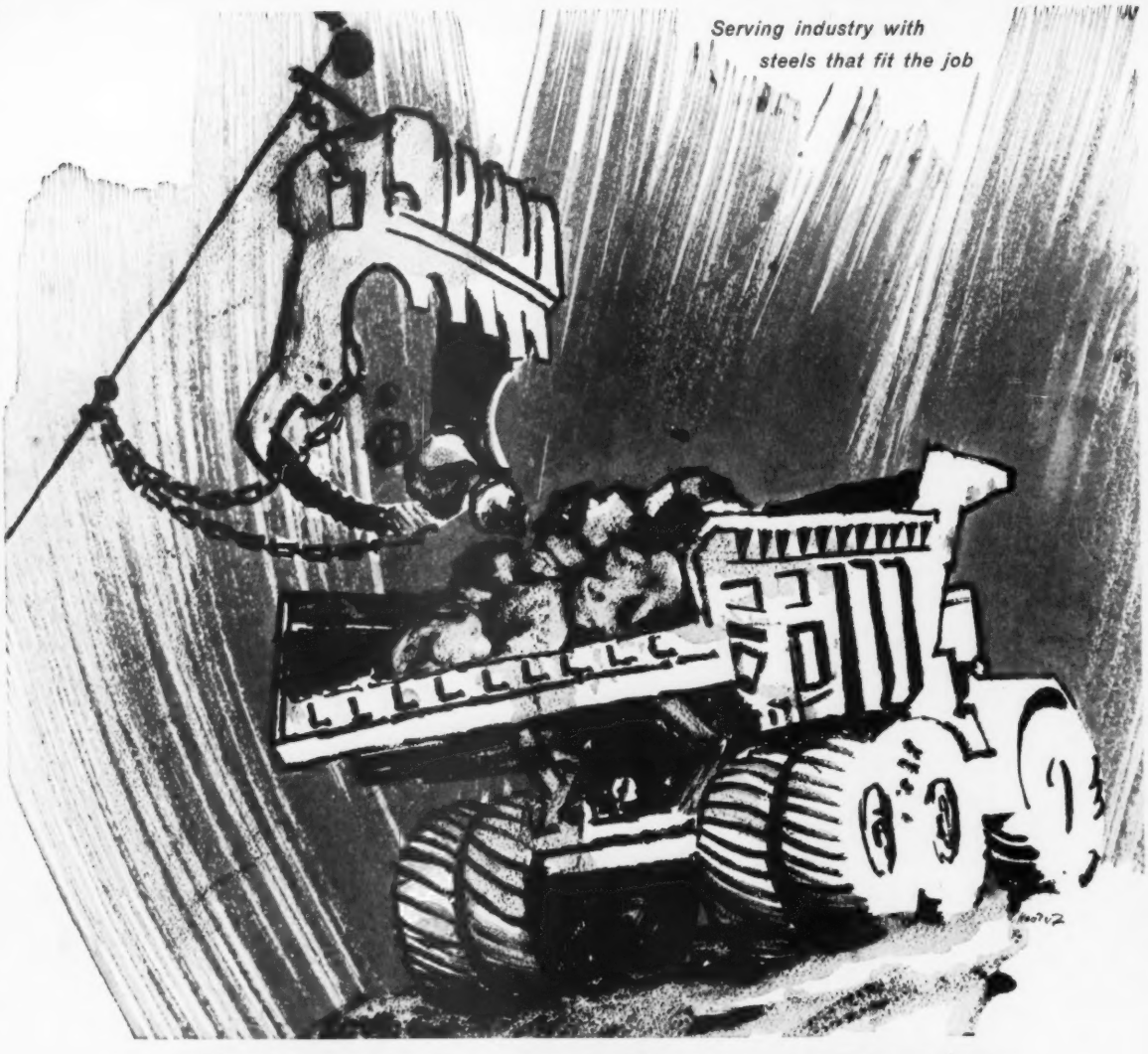
move ahead with

ALLIS-CHALMERS

power for a growing world



Serving industry with steels that fit the job



GET TOUGH

WITH LUKENS "T-1" STEEL

TRADEMARK

Where the going gets rough, versatile Lukens "T-1" steel fights back. For repair or modification of heavy duty equipment such as truck beds, chutes, bucket teeth and dozer blades, this special duty steel plate can be ordered from *warehouse stock* in a wide range of plate sizes and gages. Lukens "T-1" is the modern mining steel—you can work and weld it in the field as readily as in your shop. Its terrific resistance to abrasive impact—coupled with an extremely high yield strength—means fewer replacements and often greater payloads. That's why more and more equipment builders are using Lukens "T-1" to provide longer life in shovel buckets, trucks and other mining equipment. Remember to specify the extra-tough 321 min. BHN quality. For performance and application details, request our special booklet, "Lukens 'T-1' for Toughness." Address Manager, Application Engineering Dept., N20 Services Bldg., Lukens Steel Company, Coatesville, Pennsylvania.

You can order Lukens "T-1" steel plate from these Steel Service Centers:

Alabama, BIRMINGHAM 2, O'Neal Steel, Inc., P.O. Box 2623 • **California,** LOS ANGELES 54, Earle M. Jorgensen Co., P.O. Box 2358, Terminal Annex, 10650 S. Alameda St. • LOS ANGELES 33, The R. J. M. Company, 238-248 South Mission Rd. • **Illinois,** CHICAGO 8, Joseph T. Ryerson & Son, Inc., 16th and Rockwell Sts. • **Kentucky,** ASHLAND, Mansbach Steel Co., 19th St. and River Front • **Maryland,** BALTIMORE 2, Wm. G. Wetherall, Inc. 317 President St. • **New Mexico,** ALBUQUERQUE, Miller and Smith Mfg. Co., Inc., 500 Phoenix Ave., N. W. • **Ohio,** CLEVELAND 6, Mills-Wolf Steel Co., 12434 Cedar Rd. • **Oregon,** PORTLAND 4, J. E. Haseltine & Co., 115 S. W. Second Ave. • **Pennsylvania,** McKEES ROCKS, Follansbee Steel Co., 200 Bradley St. • **Quebec,** MONTREAL, Drummond, McCall & Co., Ltd. 930 Wellington St. • **Utah,** SALT LAKE CITY, Structural Steel & Forge Co., P. O. Box 300 • **Washington,** SEATTLE 4, Stack Steel & Supply Co., 500 Landers St. • SPOKANE 10, Union Iron Works, East 217 Montgomery Ave., P. O. Box 2135.

LUKENS

NEW CONVEYOR DESIGN

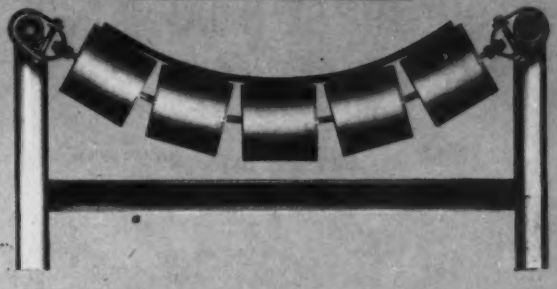
(EXCLUSIVE WITH McNALLY PITTSBURG)

...means far longer belt life!
...slashes maintenance costs!

SECRET

. . . of the improved efficiency of this new belt conveyor. This new McNally Pittsburg Cradle Idler* consists of 5" rubber rollers assembled on precision ball bearings, prelubricated, lifetime sealed. Being a *true catenary* suspension with rollers mounted on flexible, *non-rotating*, stainless steel wire rope, this design eliminates "loping" and harmonics.

RESULT



. . . is greater capacity and faster belt operation with minimum spillage. Since the belt lies in true arc with no creases or bends to cause wear, *belt life is substantially increased*. Because this unique McNally Pittsburg conveyor design is so simple, maintenance costs are lower; over-all erection time is reduced to a minimum as well.

For do-it-yourself construction, the entire conveyor is shipped disassembled and may be put together in the field to fit your conveyor needs. Also, a new "SHORTY" conveyor is available, only 2 feet high, ideally suited for use in limited working areas, above or below ground.

Write today for full details and information on this new, remarkably efficient, McNally Pittsburg Conveyor. Its new design cuts installation costs—and saves you money on belts and maintenance.

*Patents Pending

McNALLY · PITTSBURG

McNally Pittsburg Manufacturing Corporation—Manufacturing Plants: Pittsburg, Kansas • Wellston, Ohio
Engineering and Sales Offices: Chicago • Rio de Janeiro • Pittsburg, Kansas • Wellston, Ohio

Write Today

McNally Pittsburg Mfg. Corp.
Dept. E.M.J.
Pittsburg, Kansas

☐ Please send information on the new McNally Pittsburg Belt Conveyor.

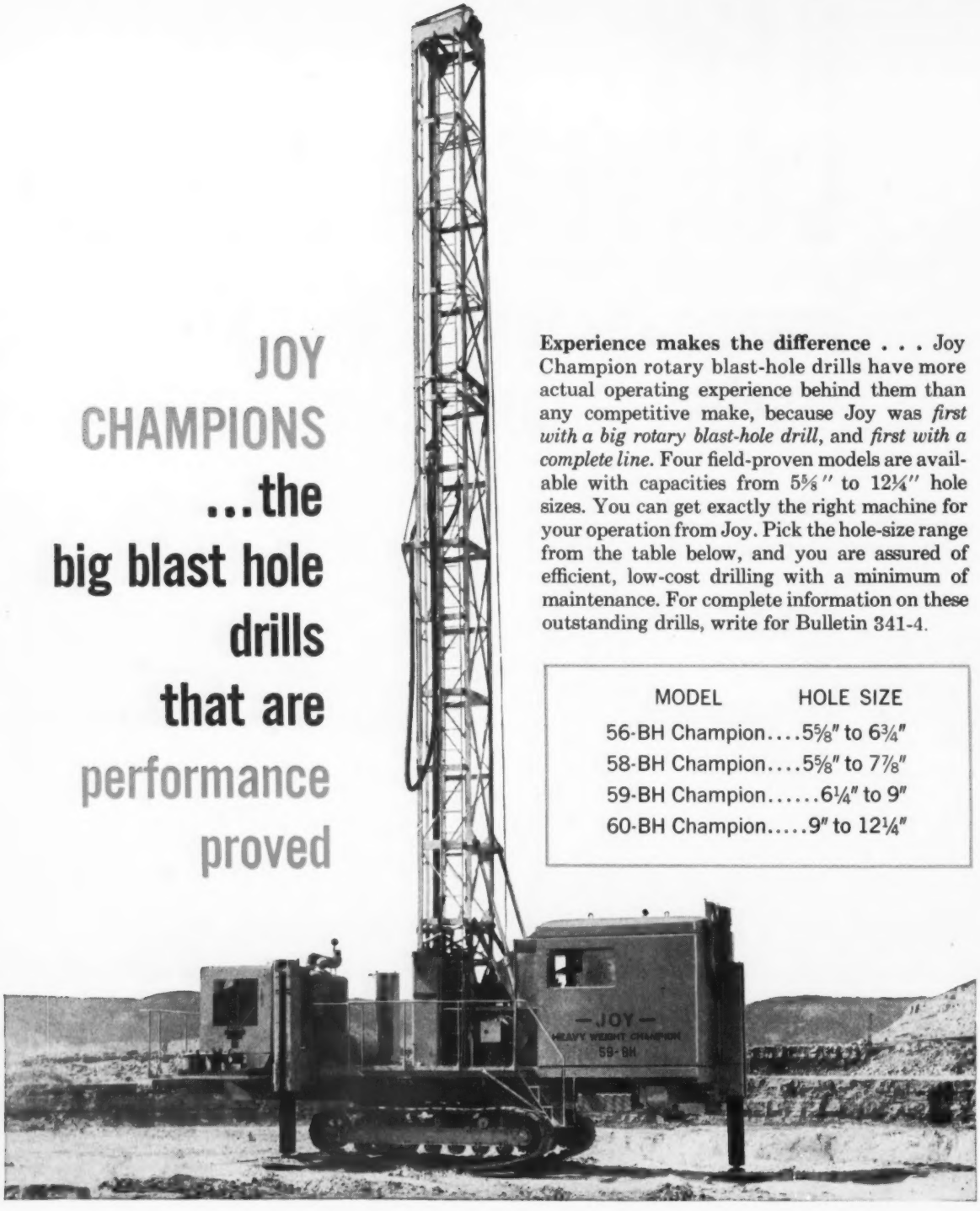
☐ Have Sales Engineer call for further consultation.

NAME _____ TITLE _____

COMPANY _____

CITY _____ STATE _____

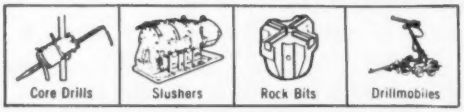
JOY CHAMPIONS ...the big blast hole drills that are performance proved



Experience makes the difference . . . Joy Champion rotary blast-hole drills have more actual operating experience behind them than any competitive make, because Joy was *first with a big rotary blast-hole drill*, and *first with a complete line.* Four field-proven models are available with capacities from 5⅝" to 12¼" hole sizes. You can get exactly the right machine for your operation from Joy. Pick the hole-size range from the table below, and you are assured of efficient, low-cost drilling with a minimum of maintenance. For complete information on these outstanding drills, write for Bulletin 341-4.

MODEL	HOLE SIZE
56-BH Champion	5⅝" to 6¾"
58-BH Champion	5⅝" to 7⅞"
59-BH Champion	6¼" to 9"
60-BH Champion	9" to 12¼"

EQUIPMENT FOR MINING... FOR ALL INDUSTRY

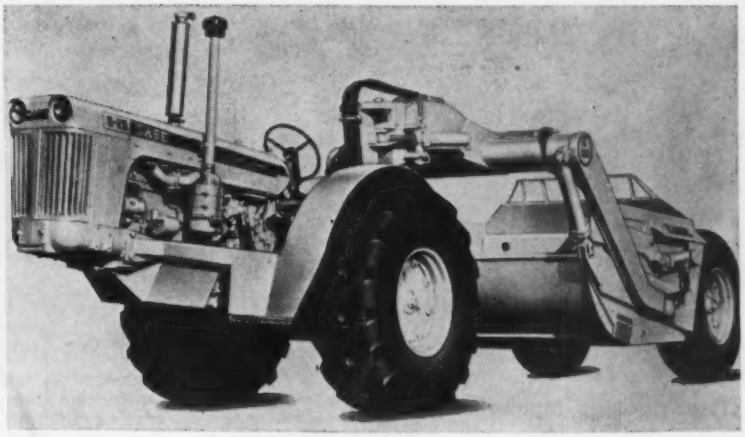


JOY

Joy Manufacturing Company
Oliver Building, Pittsburgh 22, Pa.

In Canada: Joy Manufacturing Company (Canada) Limited, Galt, Ontario

Rotjman



Case's S-20 Scraper

J. I. Case Co. To Expand Earthmoving Equipment Line

AT THE WORLD PREMIERE for 1960 in Bal Harbour, Fla., J. I. Case Co. unveiled its entire product line for 1960, and announced plans to expand its earthmoving and construction equipment line during successive years. Some 7,000 dealers, dealer personnel and their wives were flown from many parts of the world to see exhibits of the complete line and learn about equipment plans for the future.

The Case line now covers a complete series of hydraulic-drive wheel tractors; small diesel tractors which will be competitive with European imports, and a full line of construction, road-building and materials-handling wheeled and crawler tractors and equipment. Speaking of long-range plans, Marc Rotjman, president of the company and whose leadership brought Case out of the red three years ago and into a profit position, and expanded industrial sales 600% during the same period, told dealers that Case plans eventually to add trucks and shovels to its line.

Featured at the exhibit, was the 6.5-cu yd, S-20 self-propelled scraper shown above. Under test for more than a year, the S-20 is scheduled for introduction in July 1960, with larger models up to 18 cu yd to follow in 1961. The S-20 is powered by a Case-built, 80-hp diesel engine featuring a torque-converter drive with eight-speed transmission. For fast travel speeds, the hydraulic torque converter can be locked out on the go with a flip of a lever. Hydraulically-controlled steering permits full 90° turns.

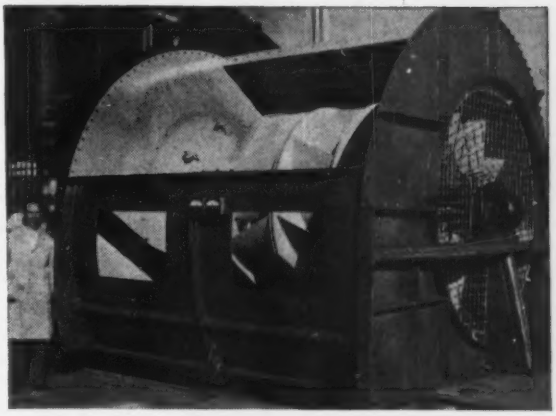
Dirt is ejected from the scraper by a one-piece tailgate and bowl bottom that is hinged directly behind the cutting edge, and tips forward hydraulically to discharge even the stickiest of material.

Also introduced at the show, was the Model W-3 2500-lb capacity gas-powered front-end wheeled loader. Capacity is 15 cu ft. This is the first of several new units which will range in capacity up to 3 cu yd. Hydraulic torque converters give the wheeled loader up to 56% greater push power than conventional gear-shift models. The unit can be switched from torque converter to direct drive while on the go.

Dealers also saw the new commercial movie, "Operations Stopwatch" which showed four different makes of front-end, tractor-mounted loaders doing identical jobs. Every move made by the operators was captured by a close-up camera. Results of this unusual time-and-motion study are fully reported in a brochure, "Operations Stopwatch," of special interest to industrial engineers.

For more information on the S-20 scraper, circle (1); on the W-3 loader, circle (2); and for the brochure "Operations Stopwatch," circle (3).

For more information on these new products and literature, circle the number on the card, address and mail to *E&MJ*.



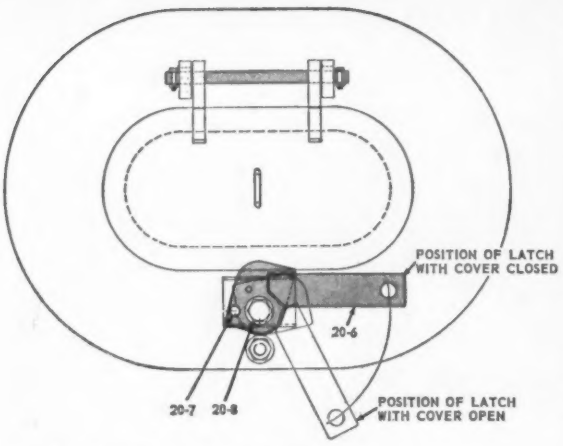
African Gold Mines Use Large Fans (4)

THE CURRENT TENDENCY to sink gold mines to levels hitherto undreamt of has produced a crop of new problems—not least among them the design of ventilation units adequate to meet the needs of men and machines many thousands of feet below ground.

These mines, the world's deepest, are being equipped with powerful ventilation plants designed and built by local engineers and technicians entirely from South African materials. A product of the Airtec Engineering Co. (Pty.) Ltd., of Johannesburg, the first batch will be installed in some of the new mines this year.

The first contract is for four high-capacity units, each of 400,000 cfm at 30 in. W.G., each driven by a 2,600-hp motor. They will be used at Harmony, one of Rand Mines' properties. The second is also for four units but of much larger capacity. Each producing 550,000 cfm at 24 in. W.G., they will be used at Western Deep Levels, one of the Anglo-American mines still in the development stage.

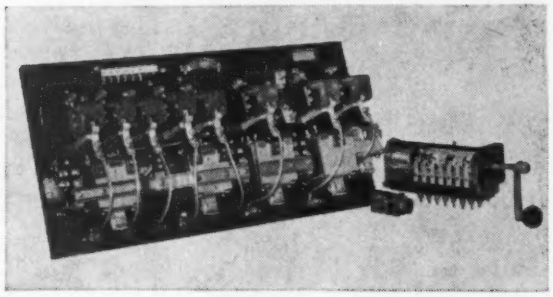
The third contract calls for two units each of 575,000 cfm at 23 in. W.G. They are for Vaal Reefs. These units embody some of the most advanced developments in the aerodynamic and mechanical design of radial flow fans. They are built to maintain high efficiencies over a wide range of volume with considerable reserve in pressure. Their basic strength combined with the considerable structural toughness of the rotor make the fans particularly suitable for handling large volumes at high pressure.



Quick-Opening Manhole Cover (6)

A QUICK-OPENING manhole cover has been designed by Allis-Chalmers Mfg. Co. which permits dumping a grinding-mill load for speedy and efficient maintenance servicing. Converting a grinding mill's regular cover to the quick-opening manhole cover is simple. First, the mill is stopped with the regular cover in top position by means of the manhole positioning control selector switch. Upon removal of the regular cover and liner, the quick-opening manhole cover is attached to a hinge on the mill shell with a pin; the release latch is locked and secured, and the mill brought up to operating speed.

The mill is then stopped with the manhole in the bottom position. A chain or cable lanyard at least 50 ft in length is attached to the release latch, the latch-locking bolt removed, and the latch pulled to release the cover and discharge the grinding media.



Mine Car Control Panel (5)

A SEMI-AUTOMATIC control developed by Allis-Chalmers Mfg. Co. for man mine cars permit safer and speedier transportation of miners to their job sites, according to the company. The new device consists of a control panel, a remote pistol grip master switch, and a dynamic brake pushbutton for slowdown action on slopes. A new safety feature is the control's forward-off-reverse master switch which is designed to return to the "off" position if the operator removes his hand from the grip. All controls are contained in permissive (explosion-proof) enclosures. The device is currently being used in man cars powered by 7½ and 15-hp, 250-volt dc motors to provide automatically controlled acceleration at speeds from four to five times faster than the conventional mine locomotive. With its use the operator need only select the desired speed and direction of the car.

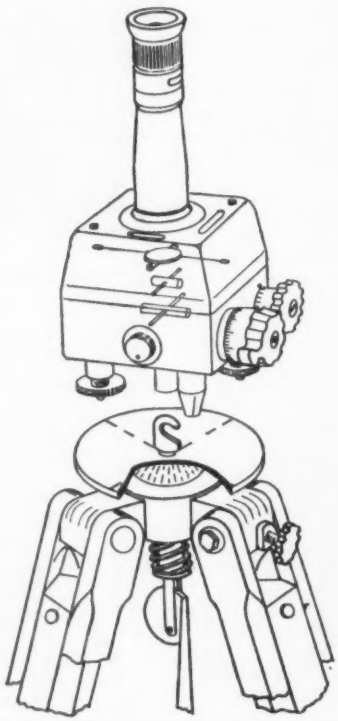
Boling

Hitch

At its November meeting, the board of directors of Dorr-Oliver Inc. appointed **J. D. Hitch, Jr.**, president, to fill its vacant board chairmanship and elected **L. R. Boling**, currently executive vice president, to succeed Mr. Hitch as president. Both appointments became effective on Dec. 1, with Mr. Boling continuing as chief executive officer of the company. **Dr. John V. N. Dorr** and **William L. Oliver** will continue as honorary chairman and vice chairman of the board respectively.

Mr. Hitch joined the former Dorr organization in 1927, and, after six years as the company's representative in Japan, was appointed export manager in 1935. He was successively elected vice president for sales and a director of the corporation, executive vice president, and president in 1953. With merger of Dorr and Oliver in late 1954, Mr. Hitch became president and a director.

Mr. Boling joined the company in 1941 following eight years with California Spray Chemical Corp. He served successively as assistant controller, controller, secretary and treasurer of the former Oliver United Filters organization.



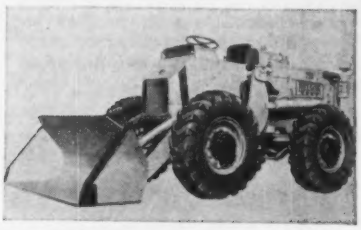
Vertical Variometer (12)

THE NEWEST model of AB Elektrisk Malmletning's MZ-4 Magnetometer is available for delivery according to literature just released. The MZ-4, like the earlier models in the series, consists basically of a small magnetic needle, suspended on a thin horizontal torsion wire and free to turn about the wire's axis; when the needle is horizontal there is no torsion in the suspension wire and, as all measurements are taken with the needle in this position these will be free from elastic aftereffect. The vertical component of the earth's magnetic field deflects the needle from its horizontal reference position, and a mirror fitted to the needle shows this deflection in the autocoolimator. The needle is brought back to its horizontal reference by a magnetic field which opposes the earth's vertical field and which is produced by two internal compensating magnets. These compensating magnets are adjusted by two controls on the side of the magnetometer.

Berylometer Finds Beryl (10)

THE BERYLOMETER represents a major breakthrough in the field exploration of beryllium. The portable detector weighs less than 25 lb and can be carried into the field by a two-man team. Antimony 124, which provides the gamma radiation source and has a 60 day half-

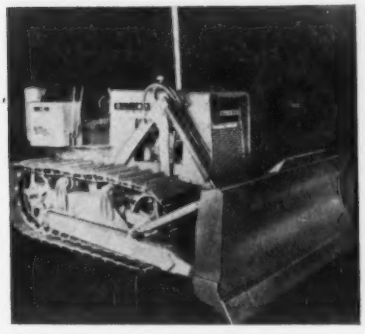
life, is sealed in a metal capsule (right). When in use, the shield is attached to the lower part of the 5-in. photomultiplier tube (center). For measuring beryllium samples, there is either an impulse counter for quantitative assaying or earphones (both left). The Berylometer is manufactured and marketed in the U.S. by Nuclear Corp. of America.



Wheeled Tractor-Shovel (17)

THE N. P. NELSON IRON WORKS announced the addition of the Model 150, 1½ cu yd capacity, to their tractor-shovel line. This tractor-shovel, with Nelson Power-Balance, has been designed and built for extra heavy duty work with maximum speed and working efficiency.

Some of the Model 150 features are —Nelson underslung arms with 100% operator visibility and safety. 40° tip-back bucket at ground level. Maximum dumping height under bucket edge of 9 ft. Forward reach at 7-ft dumping height is 5 ft 2 in.



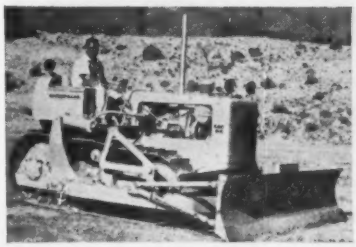
Crawler Tractor-Shovel (18)

THIS TRACTOR model—OC-9—features "powerized" steering with three types of turns. Oliver Corp.'s Trans-O-Matic transmission, with full power-assisted operation, introduces a new concept of operating ease, it is claimed. With little effort, the operator can spot-turn on one track or execute a counter-rotation turn, or the operator can make gradual turns within any radius. Each method of steering is smooth and easy, accomplished by hydraulically actuated disc clutches, operating in oil. Powered by a 4-cylinder, valve-in-head diesel engine, the OC-9 is rated to deliver 62 gross engine hp, 57-net flywheel hp. The bare tractor weighs 9,675 lb. The OC-9 is also available in a factory-built, 1-yd loader model, the OC-96. This features low-profile design with all loader components below the engine head for finest possible visibility and safety.

All-Hydraulic Bowl Scraper Has Turbocharged 340-hp Engine (22)

ALL-HYDRAULIC TS-360 motor scraper with a 30-cu. yd. heaped capacity and a 22.3 cu. yd. struck capacity is available from Allis-Chalmers Mfg. Co. This 63,-150-lb unit is powered by the Allis-Chalmers turbocharged 21000 engine, developing 340 hp at 2,000 rpm. Double-acting hydraulic bowl lift jacks assure tremendous force at the cutting edge for penetration into tough-loading materials. Hydraulic power is furnished by a tandem pump, gear-driven from rear of engine crankshaft to provide instant controlled response for positive steering and scraper operations.

The TS-360's double-acting steering jacks and multiplier links provide the unit with exceptional maneuverability. A 90° turn either way can be accomplished with only a one-sixth turn of the steering wheel. Full 180° turns can be made within a width of 35 ft 8 in.



Caterpillar Tractor (19)

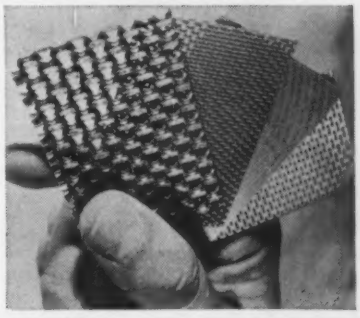
A NEW MODEL of D4 tractor, the Series C, has been announced by Caterpillar Tractor Co. Rated at 52-drawbar hp, the tractor has 25% more lugging ability than previous models, a new starting system and greater ground clearance. Available with either a standard or an optional, lower speed transmission, the new D4 is the first in its size class to have a forward-reverse lever. The new spur gear transmission has five speeds forward and four in reverse and permits quick forward-reverse shifting. This is also the first tractor of its size to incorporate the new dry type air cleaner. This new air cleaner is at least 99.8% efficient.

Off Highway Trucks (20)

THREE OFF-HIGHWAY TRUCKS for construction, mining, logging, and oilfield operations have been introduced by The White Motor Co. giving White a complete line of single and tandem axle trucks for off-highway work. One of the new units. White Model 4400D-OH—is diesel powered and has single rear axle. The others—the single-axle model 4200-OH and tandem-axle 9064-OH—are driven by White Mustang gas engines. The three new models supplement White 4264-OH and 4464D-OH tandem and 3026-OH single axle off-highway models introduced earlier this year.

Drop-Ball Truck-Crane (21)

ONE OF FIVE NEW TRUCK CRANE MODELS introduced by Harnischfeger Corp. is the 40-ton P&H 565A-TC. Capacities range from 35 through 80 tons. Drop-ball secondary fragmentation of pre-blasted material in open-pit mining has proved a popular application for the 40-ton model. Truck cranes are preferred for such work because of the wide spread ground bearing points of their wheels. Also, pneumatic tires help dissipate impacts created by release of the ball. Among exclusive features of the P&H 565A-TC is a patented method of transmitting power electro-magnetically for swing. This system, called Magnetorque, eliminates friction clutches and requires no lining replacements, adjustments or maintenance.

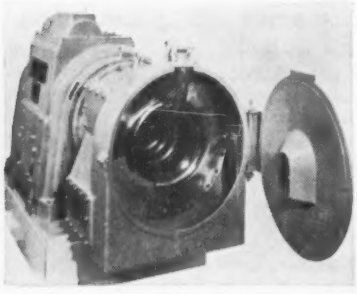


Pierced-Sheet Screens (25)

A PIERCED METAL-SHEET known as Conidure and made by a patented process has been introduced by Cross Perforated Metals, National-Standard Co. Conidure lasts up to three times longer than perforated metal for screening, recovering, or dewatering coal, aggregate, chemical solutions and similar solids-bearings li-

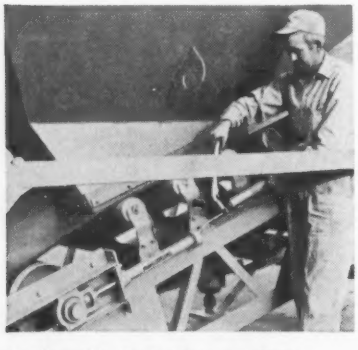
quids passing through gravity or centrifugal separators. Throughput efficiencies with Conidure pierced metal are substantially higher than with perforated metal screens.

Conidure is made by a patented process licensed to National-Standard. Trapezoidal holes are pierced in sheets of carbon steel, stainless steel, copper, brass or aluminum. Sheet thickness can be up to seven times hole diameter. Hole diameters range from 0.004 to 0.099 in., and sheet thicknesses range from 0.014 to 0.079 in.



Washing Centrifuge (26)

IMPROVED washing efficiency, more thorough washing of the cake with a minimum of wash liquor, and increased cake dryness are advantages cited for a new multi-stage, push-type centrifugal separator now offered to chemical processing industries by Baker Perkins Inc. A development of Escher-Wyss of Switzerland, and offered in this country under exclusive license agreement, the machine is so versatile in the field of filtering that it will handle slower draining materials ranging from minerals to pharmaceutical substances—even those with particle sizes in the 50 to 100 micron range—on a continuous basis. The machine, which can be built for capacities of a few hundred lb to 50 tph, makes use of a multiple number of baskets.

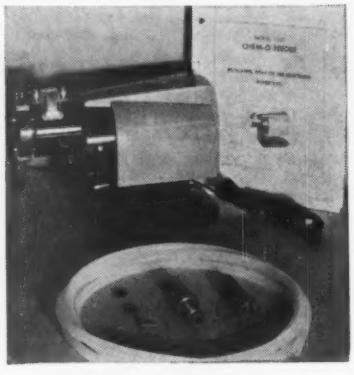


Hydraulic Belt Tensor (28)

SHOWN above is Western Conveyor Co.'s hydraulic adjuster called the Schrock Hydraligner which provides variable positioning of a conveyor pulley for proper belt tension and alignment. It consists of a hydraulic cylinder attached to a bearing housing. The piston is moved by pressure applied with an ordinary grease gun, and it holds its position with pressure maintained by positive-action piston seals. The Hydraligner is available in shaft sizes from $1^{15}/_{16}$ through $3^{7}/_{16}$ in. Standard adjustment stroke lengths are 14, 18, 24 and 36 in.

Pilot Plant Dryer (27)

STANDARD STEEL CORP. has added a new pilot model to its battery of dryers in its testing laboratory. The new unit was specifically designed by Standard engineers in 316 stainless steel on an adjustable frame. The 15-in. dia. by 8-ft. model can be set up for either counter- or parallel-flow at both high and low temperature. It can be adapted to use steam-heated air for low temperature drying applications.



Chemical Pump (29)

A LOW-COST, electrically-driven Chem-O-Feeder for proportioning of concentrated corrosive chemicals has been announced by B-I-F Industries, Inc. The diaphragm-type Model 1331 Proportioneers Chem-O-Feeder positive-displacement pump is easily installed, either floor, shelf or wall-mounted, and takes suction directly from the shipping container. Range is over 4 to 1 with capacity up to 0.7 gph into discharge pressures up to 100 psig. Complete package ready for installation consists of the pump, foot valve, injection nozzle, connecting hoses and instructions.

Anode Mold Wash (31)

CALAMO—a recently developed Harbison-Walker product for use as an anode mold wash—is now being ordered in carload lots by a number of copper companies, following very satisfactory trial use. Calamo is an alumina-silica refractory, specially developed by Harbison-Walker to meet an increasing demand for a good anode mold wash.

Potable Water Flocculant (30)

IMMEDIATE availability of Purifloc N17, a synthetic high-purity flocculant produced especially for use in the treatment of potable water, has been announced by Dow Chemical Co.

Recently cleared for use in potable water by the U.S. Public Health Service, Purifloc N17 is described as a "synthetic, high molecular weight flocculant with high activity for many types of suspended solids normally found in natural waters and produced by chemical treatment."

Dow feels this high activity has practical applications in water treatment and purification systems to produce a better quality water at lower cost.

Suggested applications include use as a primary coagulant for presedimentation, conventional and high-rate (sludge-blanket) water-treatment plants; as a coagulant aid to enhance the activity of primary flocculants such as alum and ferric sulfate; as a coagulant or coagulant aid in chemical water softening operations.

Heavy Nylon Belt (32)

AN ENTIRELY new concept in a conveyor belt has been announced by Russel Mfg. Co.—a heavy nylon yarn loomed to produce a complete belt at one time. The space between the yarns is filled with a specially compounded polyvinyl chloride; the result of a long research program to develop a better conveyor belt. These rope-like yarns separated by plastic, produce a lightweight, high-strength, fire-resistant material which out-performs conventional rubber conveyor belting wherever it is used. Its non-corrosive, non-tearing, abrasive-resistant strength insures longer trouble-free usage.

Grate-Kiln Sintering (33)

HUMBOLDT MINING CO., owned jointly by Cleveland-Cliffs Iron Co. and the Ford Motor Co., will expand iron ore mining and concentrating operations near Ishpeming, Mich., by installing two parallel lines of Allis-Chalmers Grate-Kiln sintering systems. The combination of enclosed, traveling chain-type grate and short rotary kiln has already been applied commercially for other processes, such as cement manufacture, and is noted for characteristic cleanliness and fuel economy. However, the installation at Ishpeming will be the first full-scale operation of the system to carry out an iron ore agglomeration process. Production of specular hematite from Humboldt's open-pit mine and concentrator is presently 1,000 tpd of concentrates. This rate will be doubled to meet the needs of each new 1000 tpd line of Grate-Kiln equipment. The facility is scheduled to begin producing iron ore pellets around mid-1960.

For Your Files

This selected manufacturer's literature is free unless otherwise specified. If item is for sale, send request and money direct to manufacturer.

DIAMOND DRILL BITS in the Anton Smit & Co. line are illustrated and discussed in a 16-page catalog which gives detailed information, specifications and prices. (No. 502). **(60)**

MINE CAR WHEELS of forged steel are the subject of a four-page bulletin from Bethlehem Steel Co. **(61)**

HOW TO USE and install MP-3 control units for motive-power charging is the title of a six-page brochure prepared by Exide Industrial Div., Electric Storage Battery Co. (5092) **(62)**

HEAVY-DUTY BATTERIES for powering mine and tunnel haulage equipment is the title of a four-page bulletin prepared by C&D Batteries (ML-568). **(63)**

TRACK TURNOUT and curve data sheet prepared by Bethlehem Steel Co. contains a table and diagram showing distances from a point of a frog to point of intersection, and from point of intersection to point of tangency for crosscuts at angles of 20, 30, 45, 60 and 90° (705). 4pp. **(64)**

EQUIPMENT LEASING PLAN brought to your attention in 1959 is the subject of a six-page bulletin from U.S. Leasing Corp. **(65)**

EXPLOSIVE IMPACT HARDENING for metals—a process developed by E. I. du Pont de Nemours & Co.—is detailed in a four-page bulletin which offers more recent data than the article in E&MJ, January 1959, p 47-48. **(66)**

MIXER-SETTLER unit for solvent extraction is discussed in a design study bulletin (MF M7-F65) from Denver Equipment Co. **(67)**

ROTAMETERS and functional accessories in the Brooks Rotameter Co. line are presented in a five-page folder (110). **(68)**

FLOCCULANTS available from American Cyanamid Co. are thoroughly detailed in a 20-page bulletin on the Aerofloc and Superfloc synthetic flocculants. **(69)**

NEW DEVELOPMENTS in mining chemicals—a 13-page booklet from American Cyanamid Co. — provides descriptions and suggests used for 13 Cyanamid mining chemicals. **(70)**

DECO TREFOIL for November-December 1959 contains complete details of Cia. Real del Monte y Pachuca tailings reclamation project (see p 94, November E&MJ). **(71)**

THE DOW FLOTATION INDEX—29th annual edition for the year 1959—is available from Dow Chemical Co. 15pp. **(72)**

WIRE CLOTH and screen cloth in the Multi-Metal Wire Cloth Co., Inc. line are illustrated in a 31-page bulletin. **(73)**

FILTRATION with Dicalite filteraids is the title of an informative 20-page technical service bulletin (B-13) prepared by Mining & Mineral Products Div., Great Lakes Carbon Corp. **(74)**

PNEUMATIC integrator for belt weigher—a new product developed by B-I-F Industries, Inc. multiplies belt travel and belt loading to produce a direct readout of the weight being conveyed over the weighing section of the Conveyoflo instrument, according to literature available on the Integrator-Totalizer. **(75)**

DRIVES, BELTS and pulleys in the T. B. Wood's Sons Co. line are detailed in a 32-page bulletin (9102). **(76)**

VERTICAL motoreducers and in-line reducers catalog (MR-58) from Philadelphia Gear Corp. is a complete selection guide for reducers in eight housing sizes for applications up to 125hp and speeds ranging from 9 to 420 rpm. **(77)**

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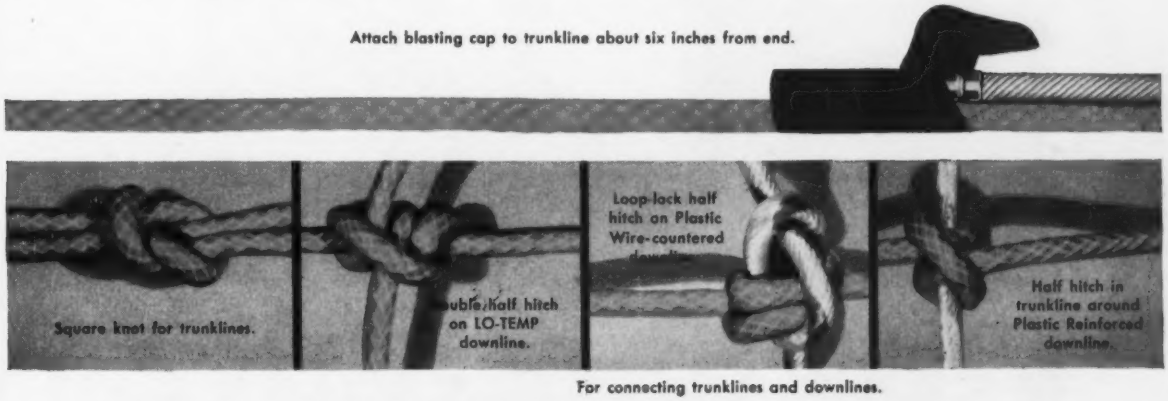
When Old Man Winter is on the loose, you can still make tight knot connections with Primacord downlines when your trunkline is Lo-Temp Primacord. It remains flexible at low temperatures and its plastic cover and textured surface resists slip-back. Ideal for trunklines at any time and can be used for in-hole priming wherever conditions do not call for more rugged types. Lo-Temp is resistant to oil and water penetration, is light in weight, tough, strong, easy to handle.

Like all types of Primacord, Lo-Temp is very insensitive to initiation by shock, friction, sparks or electricity, but must be initiated with fuse and cap or electric blasting cap. It explodes at a velocity of 21,000 feet per second with the initiating energy of a blasting cap throughout its entire length.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Square knot for trunklines.
Double half hitch on LO-TEMP downline.
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For connecting trunklines and downlines.

THE ENSIGN-BICKFORD COMPANY

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For 12 years the tonnage went UP, UP, UP

and down, down went haulage costs for Chilean Exploration Co. This belt became a record breaker when it completed conveying the amazing total of 100 million tons of abrasive copper ore. Then it went on to surpass this figure, conveying a total of 130,886,134 tons at an average cost of $.00037 per ton.

Not only did this belt resist the extreme abrasive action of copper ore—it was completely unhoused and exposed to the blistering rays of the sun all year round.

THESE BELTS are just some of the "U.S." standouts which demonstrate, year after year, why "U.S." is the world's foremost authority on the design and production of conveyor belts.

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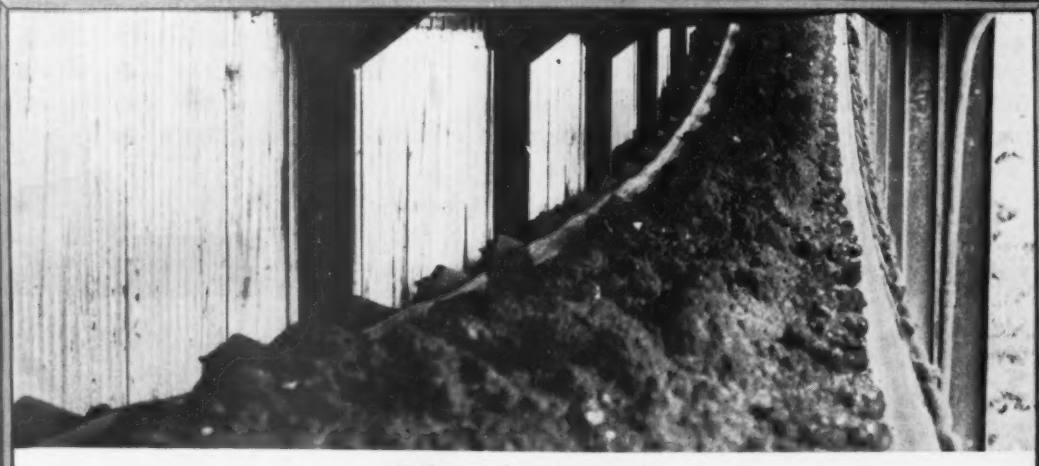

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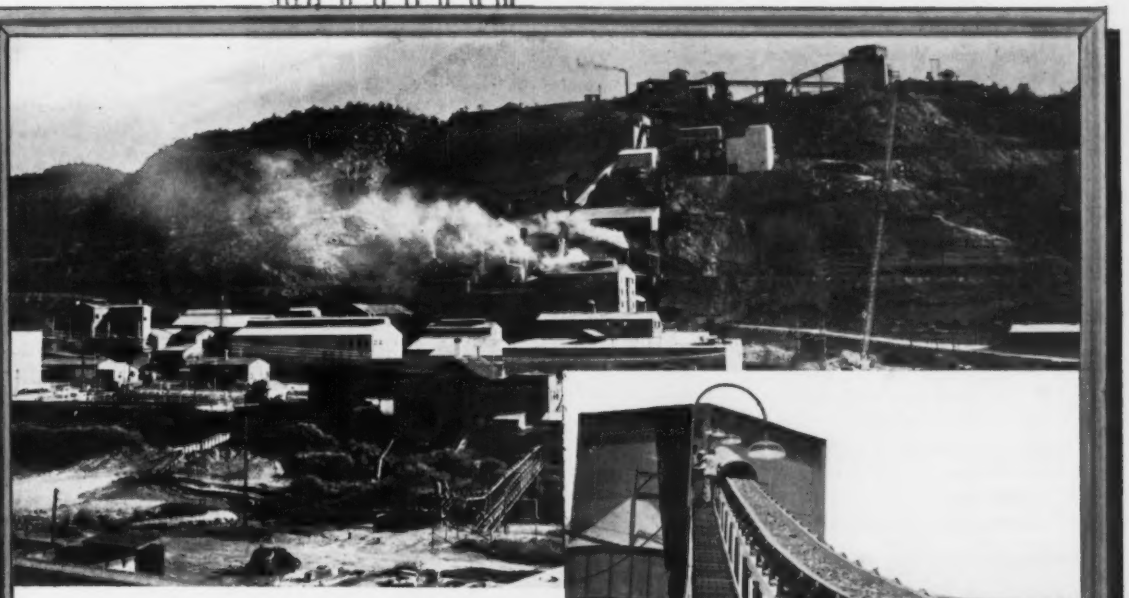

LARGE URANIUM PRODUCER picks dozens of "U.S." Belts for a dozen different uses

Union Carbide's plant at Uraven, Colorado, one of the nation's biggest uranium processing plants, operates on a 3-shift, 7-day-a-week basis. U.S. Rubber Conveyor Belts play a vital part in its operation.

This has been true from the very start of the operation. For example, when a large addition to the plant was completed, U.S. Rubber supplied 16 new conveyor belts. With this addition, more than three dozen "U.S." Belts now help carry the vital tonnage through the various phases of uranium processing.

One U.S. Giant® belt handling hot materials has *outlasted previous belts four to five times.*

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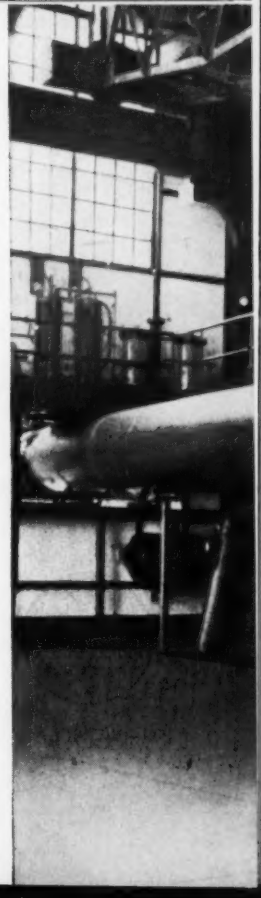
in MINING SERVICE

AT GUNNAR MINES, LIMITED . . . Neither bitter cold, nor inaccessible location could stop the successful development of a strategically valuable uranium ore deposit by Gunnar Mines, Limited, located in northwest Saskatchewan, less than 450 miles south of the Arctic Circle.

To meet the electrical power requirements for the construction and operation of mine, mill and town facilities, Gunnar chose seven Nordberg Supairthermal® 4-cycle diesel engine-generator units, each rated 1200 hp at 450 rpm, direct connected to 845 kw generators. Adding to the efficiency of this installation are waste heat boilers which utilize exhaust gas from the Nordberg engines to produce steam for heating plant buildings.



AT ANGLO-LAUTARO NITRATE CORPORATION . . . The story of power plant expansion for Anglo-Lautaro Nitrate Corporation's vast operations in northern Chile is largely a story of reliable Nordberg power. Their original Nordberg engine was a 7100 hp diesel unit installed in the Pedro de Valdivia plant, followed by the installation of two 1900 hp Nordberg diesels for the plant at María Elena. Then, to meet much needed additional power, two big 9600 hp Nordberg diesels were installed in a new power plant at Coya Sur.

Now Anglo-Lautaro has again turned to Nordberg to meet further power expansion, and has ordered *five more* Nordberg diesels, each rated 5750 hp, to be installed in the Pedro de Valdivia power plant. When these new engines are put in service, the combined generating capacity of all ten Nordberg engines will provide over 38,000 kilowatts for nitrate production.

While these installations in Saskatchewan and Chile are widely separated geographically, they serve as striking examples of the way in which Nordberg engines are serving the varied power requirements of the mining industry . . . especially in remote areas where dependable operation is of prime importance.

NORDBERG MANUFACTURING COMPANY
Milwaukee 1, Wisconsin

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P959

ATLANTA • CLEVELAND • DALLAS • DULUTH • HOUSTON • KANSAS CITY • MINNEAPOLIS • NEW ORLEANS • NEW YORK
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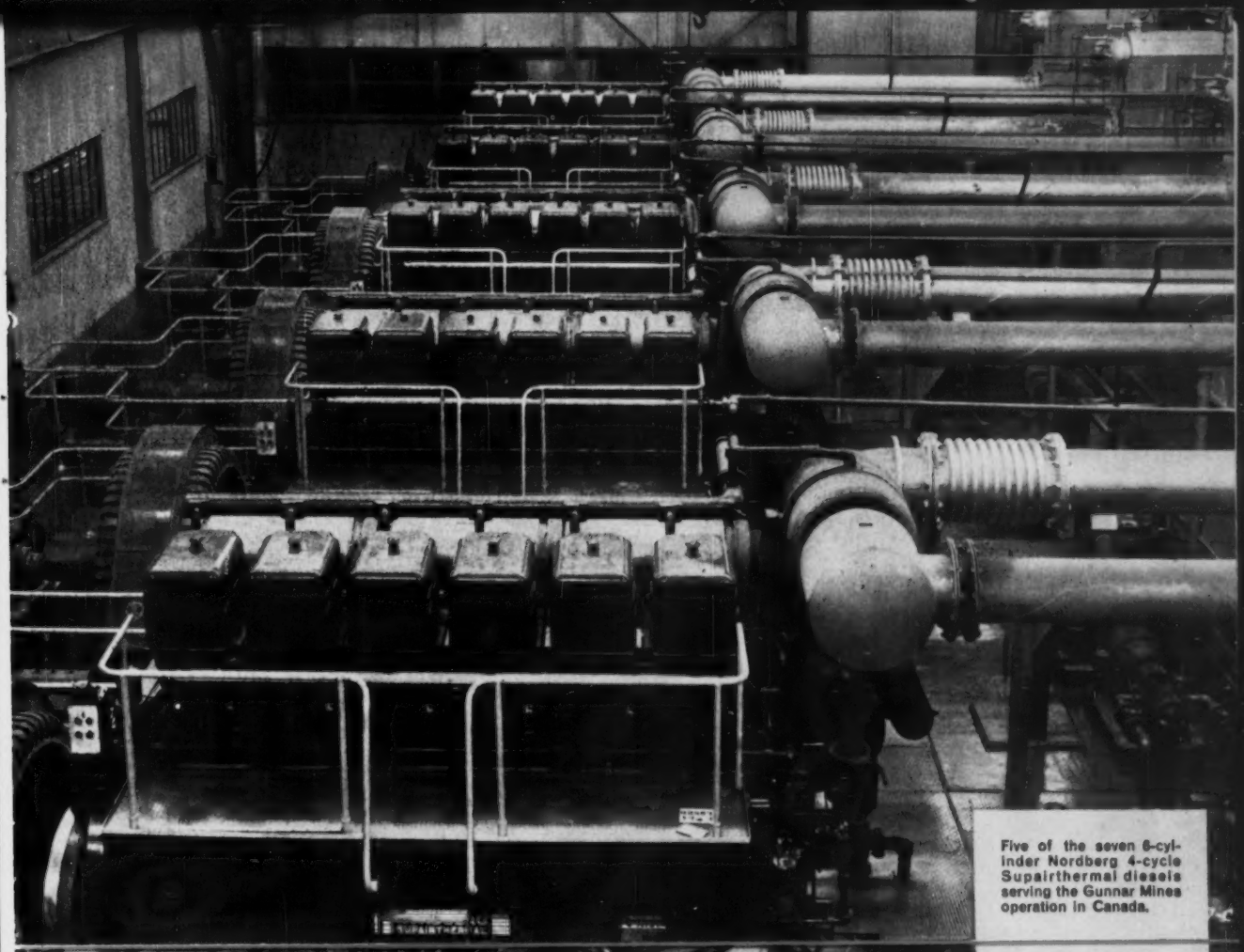
SYMONS® CONE CRUSHERS

NORDBERG GRINDING MILLS

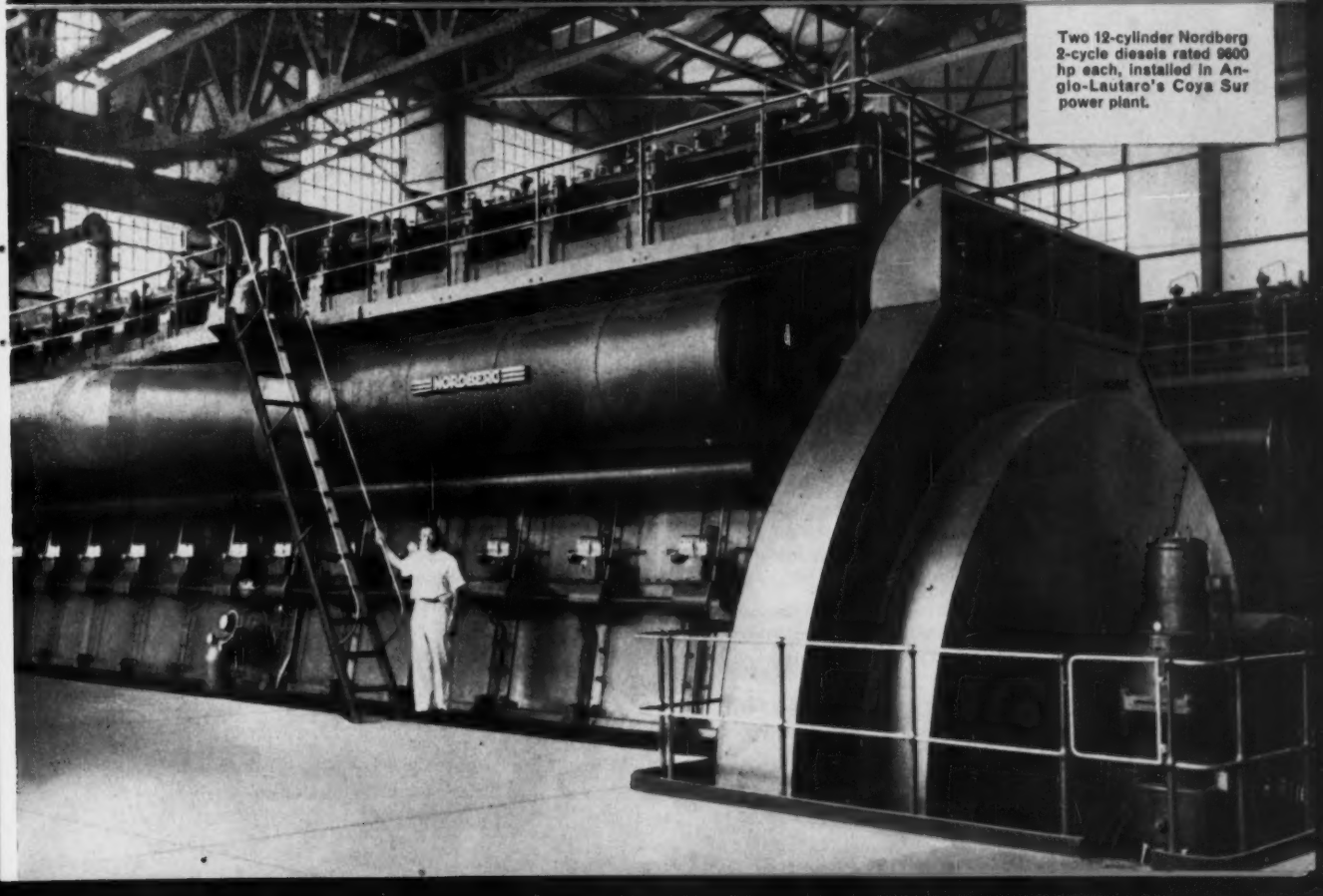
SYMONS VIBRATING SCREENS

SYMONS VIBRATING GRIZZLIES

NORDBERG MINE HOISTS



Five of the seven 6-cylinder Nordberg 4-cycle Supairthermal diesels serving the Gunnar Mines operation in Canada.



Two 12-cylinder Nordberg 2-cycle diesels rated 9600 hp each, installed in Anglo-Lautaro's Coya Sur power plant.

Industry-proved through a quarter century of service... THERE'S NO DOUBT ABOUT NEOPRENE

IS THERE A "WEAK LINK" IN THIS MINING OPERATION?

One of the first places to look is that long, vulnerable length of power cable stretching out from the shovel. It takes a real battering: crushed under tractors, dragged over sharp rocks, exposed to temperature extremes, weather, and sunlight. It takes a really rugged cable jacket to keep electrical service intact under these conditions.

But it is no worry on this job. Reason: the Anaconda cable used is jacketed with tough, durable neoprene. This particular one has been in service at Maumee Collieries' strip mine for over *ten years.*

Neoprene is the *only* cable-jacketing material with records like this to *prove* its ability to protect electrical service under the toughest mining conditions. Neoprene jacketing resists oil and grease, chemicals, heat, cold, abrasion, gouging, impact... and it won't flow under heat or pressure; it is flame resistant as well. There's no doubt about neoprene synthetic rubber. Write for complete facts to E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Department EMJ-2, Wilmington 98, Delaware.

DU PONT NEOPRENE

Better Things for Better Living... *through Chemistry*

Can your loader "lift its lip" and duplicate dozer action? No?

Then trade it off without delay! Because you'll miss money-making opportunities right and left without this big-capacity 4-in-1 action. And you have positive "radius control" of dozing depth; plus strength for hard digging! Here, the new International Drott TD-20 4-in-1 is dozing heavy gumbo material like a full-size blade!

Can your loader grade and strip like a carry-type scraper? No?

Then consider what extra service—and extra-valuable service you would have—with versatile scraper-like action at your fingertips with a moderately-priced 4-in-1! This TD-20 4-in-1 is stripping sticky clay. It can also grade or spread materials with similar accuracy.

ONLY A CLAM-ACTION 4-IN-1

can replace up to $100,000 of limited-duty equipment!

Can your loader "bottom-dump" and handle sticky materials? No?

Then retire the "relic" and go modern! You can't choose the materials you excavate. You can't prevent adverse weather that makes materials sticky! But 4-in-1 bottom-dumping eliminates the sticky materials problem and gives you a vital dumping height plus advantage over ordinary roll-forward buckets.

Move the selector lever—prove to yourself only the clam-action 4-in-1 doubles for a whole spread of "big-ticket" rigs—gives instant changeovers. Compare 4-in-1 capacity and versatility to any single-action loader. Measure exclusive shock-swallowing Hydro-Spring advantages. See your International Drott Distributor for a demonstration—prove you can save up to $100,000 on equipment!

Does your loader have measured, advertised breakout action? No?

It's the genuine and exclusive pry-over-shoe breakout action that enables International Drott 4-in-1's to replace far costlier boom-type rigs on jobs like breaking up and loading out hard, heavy stratified or embedded materials. The NEW TD-15 4-in-1 exerts the enormous force of 39,200 lbs!

International Harvester Company, Chicago 1, Illinois
Drott Manufacturing Corp., Milwaukee 15, Wisconsin

INTERNATIONAL HARVESTER

INTERNATIONAL®
DROTT®

Power-steer and power-shift

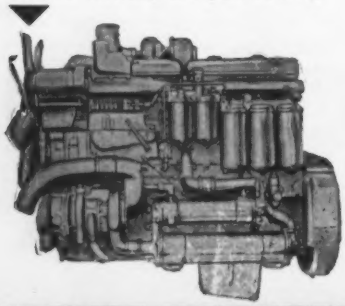
with TD-25 standard equipment ...for full-load turns ...full-speed cycles!

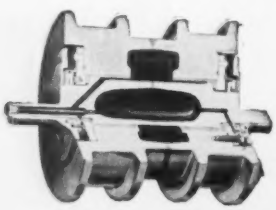
Keep big rock loads on the move *full time*, with exclusive Planet Power-steering. Full power on both tracks, full time is the answer! And Hi-Lo, on-the-go power-shifting lets you match power to condition, instantly, and keep the yard-boosting advantage of uninterrupted momentum!

Cleaning the face of a Missouri strip mine behind a big dragline, this TD-25 shoves "tractor-sized" boulders aside with the greatest of ease. The "25" also builds dragline walkways and haul roads; pushes loaded trucks; and drastically cuts the cost of clearing new stripping areas.

Big power "plus" of the new TD-25 is the new direct-start, turbocharged 6-cylinder International DT-817 diesel engine. This versatile engine also powers International Payscraper®, Paywagon®, and rear-dump Payhauler® models — plus the TD-25. Equipment-spread power standardization simplifies your servicing and parts-stocking.

Thickest-shelled roller design in the crawler industry—with king-size lube reservoirs and seal-protecting pressure-relief passages—let you power-lubricate without affecting seal life or efficiency. These are Dura-Rollers—the track rollers that make 1,000-hr lube intervals practical!





No attachment! No after-thought! No Stop-gap!

Years'-proven Planet Power-steering and Hi-Lo power-shifting are *designed-in, built-in,* basic standard equipment of the new 230-hp International TD-25.

With "live-track" Planet Power steering, you get full-load king-size crawler efficiency on turns, as well as straight-aways. And Hi-Lo power-shifting gives you on-the-go matching of power to load to give you big, cycle-speeding advantages!

International Planet Power-steering eliminates load-limiting "dead-track" drag. And Hi-Lo power-shifting does away with time-wasting "gear-shift lag." No wonder the new TD-25 can outearn king-sized clutch-steered crawlers up to 50%—on tough high-walling; overburden removal; and many other coal, mineral, or building-material mining jobs!

Big-capacity track-and-engine teamwork

New TD-25 7-roller tracks are strength-matched to team with the full effort of the New 230 hp diesel engine. The "25" is platformed on super-rugged double-box-beam frames—and carried smoothly on International's new minimum-maintenance Dura-Rollers!

Press the direct-start button, to command the "25's" free-breathing diesel horsepower. Dual valving of the "25's" high-torque DT-817 engine provides for peak turbocharging efficiency—to deliver full-rated performance from sea level to timberline!

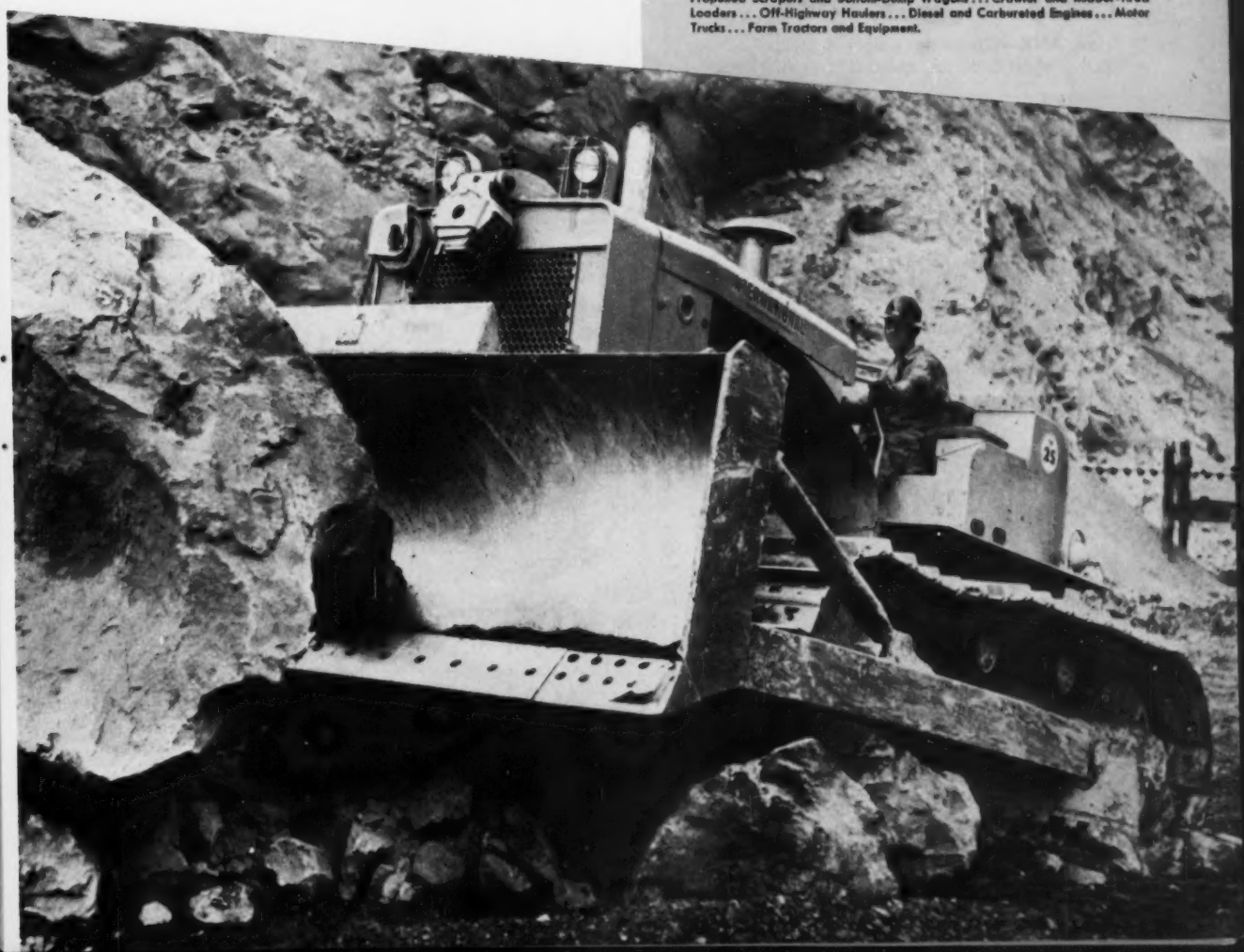
Full TD-25 performance is at your fingertips, full time!

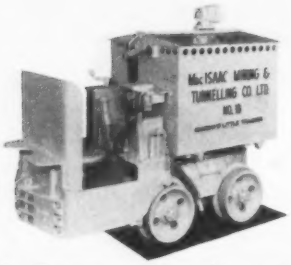
Power-shift and power-steer the new "25" with king-sized loads—around curves, upgrade, anywhere. Compare years-proven simplified International planetary design that's engineered and located to break the load-limiting, time-losing steering and shifting bottlenecks which plague king-sized clutch-steered crawlers. Measure all the "25's" standard equipment extra value features. Let your International Construction Equipment Distributor demonstrate!

International® Construction Equipment

International Harvester Co., 180 N. Michigan Ave.

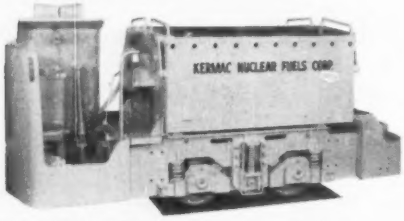
A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors . . . Self-Propelled Scrapers and Bottom-Dump Wagons . . . Crawler and Rubber-Tired Loaders . . . Off-Highway Haulers . . . Diesel and Carbureted Engines . . . Motor Trucks . . . Farm Tractors and Equipment.



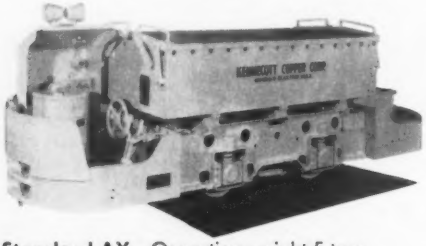


Little Trammer—Operating weight 1.7 tons, tractive effort 500 lbs, speed 4 mph.

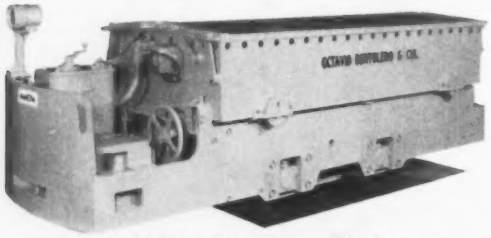
Titan BN—Operating weight 3 tons, tractive effort 800 lbs, speed 4 mph.



Titan ANX—Operating weight 4 tons, tractive effort 1600 lbs, speed 3.25 mph.



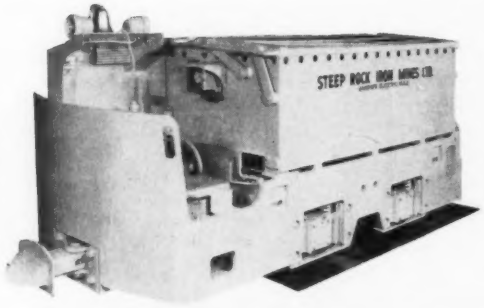
Standard AX—Operating weight 5 tons, tractive effort 1900 lbs, speed 4 mph.



Standard AX—Operating weight 6 tons, tractive effort 3600 lbs, speed 4 mph.

MANCHA storage battery locomotives

. . . A complete range of sizes for practical, low cost haulage service in metal and non-metallic mines.



Standard ABX—Operating weight 7 tons, tractive effort 2000 lbs, speed 4.25 mph.

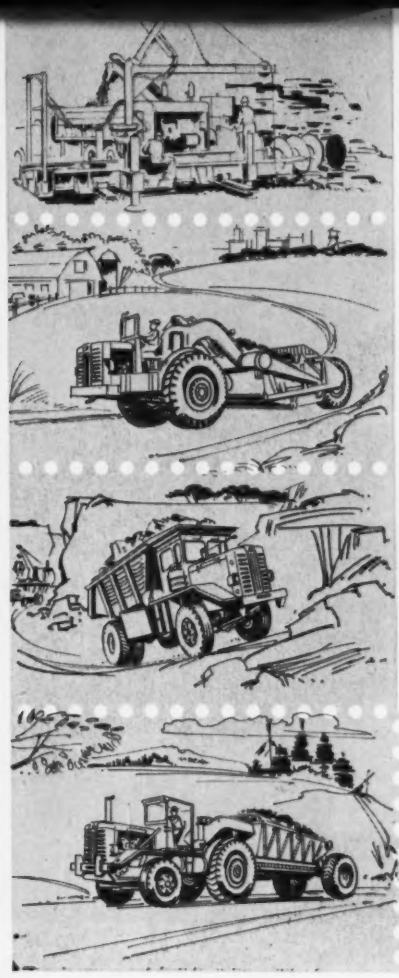
Hercules BX—Operating weight 9 tons, tractive effort 4000 lbs, speed 6 mph.

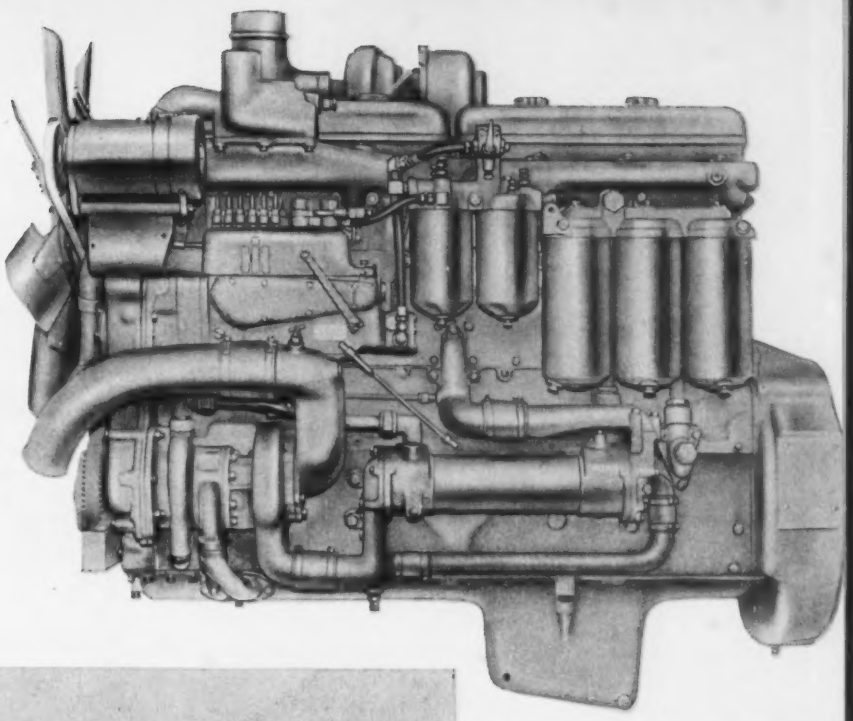
Mancha specializes in fitting the locomotive to the job. Let us know your requirements.

MANCHA LOCOMOTIVE

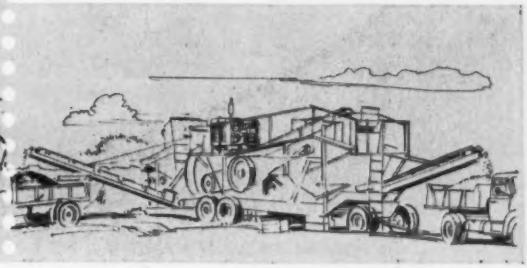
DIVISION GOODMAN MANUFACTURING COMPANY

Halsted Street and 48th Place • Chicago 9, Illinois
Cable Address: Mancha, Chicago
Mancha representatives are located in principal mining areas throughout the world.





NEW UDT-817 DIESEL is a 4-cycle turbocharged engine with 817 cu. in. displacement and max. torque of 1,040 lbs. ft. @ 1,400 rpm.



New power, performance and price leader in the 385-hp diesel class

Here are three fast facts about the turbocharged, new direct-start, direct-injection International 6-cylinder UDT-817 diesel that can mean big savings on your mining equipment:

POWER—The UDT-817, developing 385 hp., leads the field in its size class.

PERFORMANCE—The specific fuel consumption of the UDT-817 is the lowest in its size class.

PRICE—The UDT-817 is the lowest priced engine in its size class in dollars per horsepower.

A wide variety of accessory equipment including air cleaners, flywheels for leading makes of torque converters and clutches, torque converter cooler, air control compressors, safety shut-offs, instruments and engine controls can be furnished to meet your installation requirements. Base, radiator, hood and dash, clutch and power take-off are available for complete power units.

The new 250-hp. D-817 is the naturally aspirated version of this same basic diesel engine. Your nearby International Power Unit Distributor or Dealer can give you full details of either new model or on the 30 other diesel and carbureted construction equipment engines in his line. All 32 engines have one common feature—fastest payback power for users.

INTERNATIONAL®
ENGINES

International Harvester Co., 180 N. Michigan Avenue, Chicago 1, Illinois

A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors... Self-Propelled Scrapers and Bottom-Dump Wagons... Crawler and Rubber-Tired Loaders... Off-Highway Haulers... Diesel and Carbureted Engines... Motor Trucks... Farm Tractors and Equipment.

More proof that...

AMSCO HELPS YOU MOVE MORE TONS PER DOLLAR

How AMSCO screen parts and Simplex 2-Part Dipper Teeth are giving users greatly improved service life*

AT A LARGE NEW ENGLAND QUARRY

AMSCO CHUTE PLATES LAST 5 YEARS VS. 4 WEEKS FOR PREVIOUS TYPE

In the screen house of this quarry, two Amsco HC-250 abrasion-resistant chute plates are used on each Hi-G discharge screen. 500 tons per hour pass over each plate, during the two-shift, 20-hour operating day.

This installation resulted from a previous test, in which a set of Amsco plates was compared with regular carbon steel plates. The Amsco Chute Plates *lasted about 5 years,* whereas the competitive plates had to be replaced every 4 weeks.

The quarry operator reports that the Amsco plates presently installed are holding up excellently in service. Their exceptionally long life and trouble-free service means big dollar savings—through elimination of costly shutdown time.

ON THE NIAGARA POWER PROJECT

AMSCO SIMPLEX 2-PART TEETH DIG 40,000 YARDS OF ROCK BEFORE REPLACEMENT

At the right, you see the type of rugged rock excavation in which this outstanding service record was set. It's part of the Niagara Power Project—Conduit #2 South—being handled by Gull & Defelice Construction Company.

All dippers on the job are equipped with Amsco Simplex 2-Part Reversible Teeth. They operate 16 hours a day, 6 days a week—*handle approximately 40,000 yards of rock*—before tooth replacement is required.

In addition to their exceptionally long wear, the fact that Simplex Teeth *can be replaced in ten minutes with no trouble* is an important advantage to the operators. It all adds up to big savings—in replacement cost and shovel downtime.

*Patent No. 2,904,908

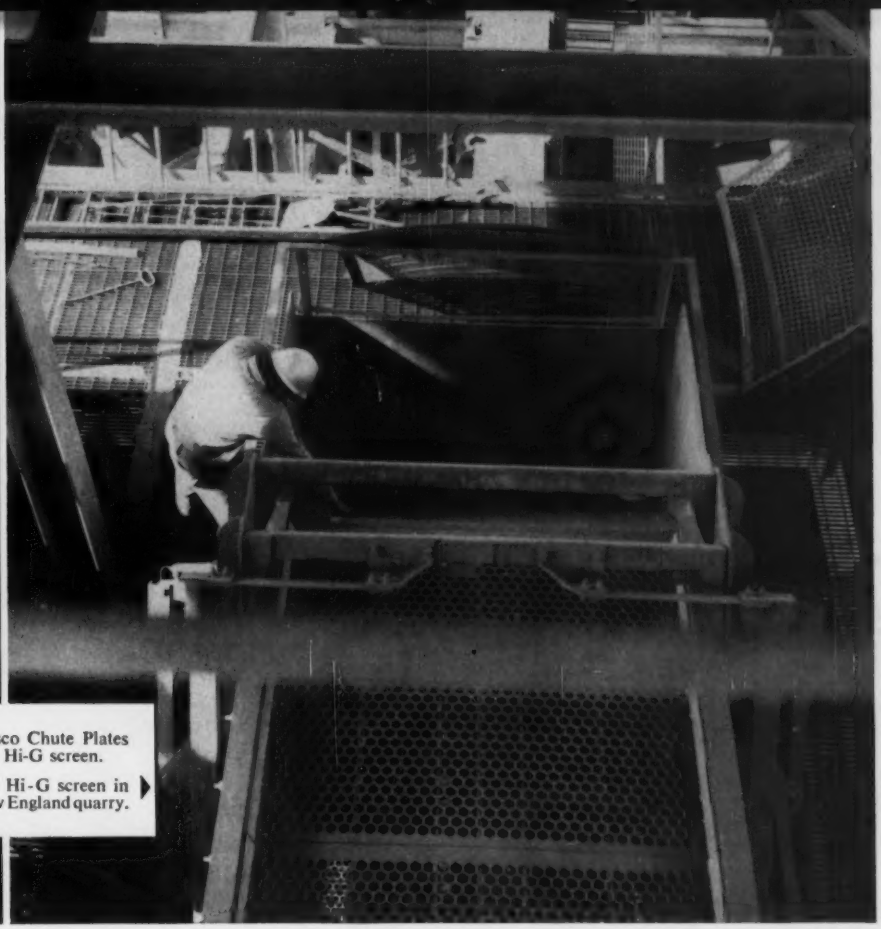
Wherever high impact and abrasion are problems, you'll "move more tons per dollar" with Amsco Dippers, Dipper Teeth and Crusher Parts. See your equipment dealer, or write us direct for technical bulletins.

AMSCO

American Manganese Steel Division • Chicago Heights, Ill.

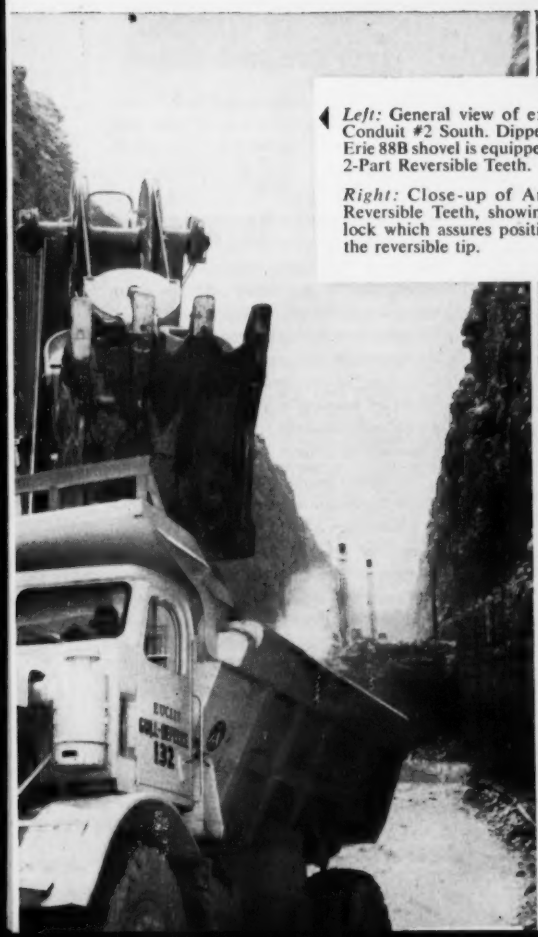
Other plants in: Denver • Los Angeles • New Castle, Dela. • Oakland, California • St. Louis
In Canada: Joliette Steel and Manitoba Steel Foundry Divisions

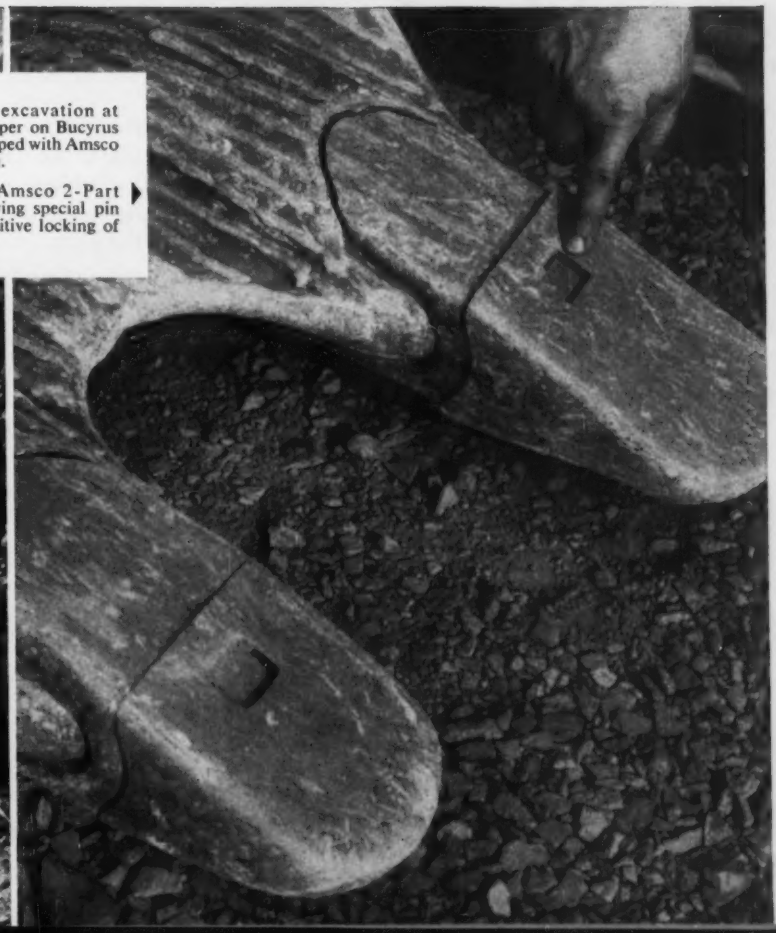
AMERICAN Brake Shoe COMPANY



Left: Close-up of Amsco Chute Plates used on each discharge Hi-G screen.

Right: General view of Hi-G screen in screen house of large New England quarry.





Left: General view of excavation at Conduit #2 South. Dipper on Bucyrus Erie 88B shovel is equipped with Amsco 2-Part Reversible Teeth.

Right: Close-up of Amsco 2-Part Reversible Teeth, showing special pin lock which assures positive locking of the reversible tip.

Why Falk Gears cost less per year of service

Experienced mill and kiln operators and engineers know that annual gear expense is determined by many factors besides the initial cost of the gears themselves. Among these factors are: tonnage handled, efficiency, and effect of gear operation on driving and driven machinery, shutdowns caused by gear failures or pinion replacements—and the service life of the gears.

By any, or all, of these standards, Falk Helical Gears are the most economical gears you can buy! They are *correctly designed, engineered and built* for highest accuracy, thanks to Falk's long and unmatched experience. All gears are *precision-hobbed* on machines designed and built by Falk. Each gear has a serial number; its pedigree is established during its course through the several shops and the many operations and tests to which it is subjected.

Repeated tests have proved that Falk Helical Gears have an efficiency of 98½% or greater—the highest obtainable!

These gears, with the smooth operation of their extra-capacity teeth, provide maximum resistance to abrasive wear—hence longer life, not only of the gears, but of driving and driven machinery. This means multiple savings for you.

Falk is the country's largest supplier of precision gearing...and has unsurpassed facilities to fill all your gear requirements.

Contact any Falk Representative—also, write for **Engineering Report 6170,** "Advantages of Helical Gearing"

THE FALK CORPORATION, 3001 W. CANAL ST., MILWAUKEE 1, WIS.

FALK is a Registered Trademark

FALK HOBBED GEARS FOR LARGE GRINDING MILLS

The 2000 hp helical gear in the small photograph above is one of nine now driving some of the largest cement mills in the country.

All Falk Helical Gears, both single and herringbone, are precision-hobbed on special Falk-built hobbers of highest accuracy. Falk gear hobbers have incorporated in the design of the gear train a mechanism which is extremely effective in reducing tooth-spacing errors to negligible values. The accuracy inherent in the machines has the salutary effect of insuring perfect load division between the several teeth that are simultaneously in contact in helical gears.

Finish hobbing is done in a room where the temperature is controlled within a variation of two degrees. This is a precaution against possible dimensional changes of the gear during the all-important finishing operation—changes which might affect ultimate accuracy.

FALK

...a good name in industry

"Imagination... is the source of human improvement; experience its implement"

The giant new Copper Smelter of Kennecott Copper Corporation, Hayden, Arizona; designed, engineered and built by WKE.

MINERAL ENGINEERING: MAKING THE MOST OF THE EARTH'S RICHES

The measure of civilization's progress, through the ages, has been man's capacity to produce and put the earth's minerals to work for him.

Today, mineral engineering is a highly developed art based on knowledge and integration of techniques, processes, equipment—and economic feasibility; thus WKE's position of pre-eminence in the field. WKE experience covers virtually every economically significant mineral and metal. For example: selenium to iron ore; uranium to aggregate; 10 of the 25 U. S. uranium plants; 22 iron ore plants; 2 of the 3 recently completed copper smelters in the United States.

WKE's world-wide mineral engineering service can help you get more from a mineral deposit, from planning and execution of exploration drilling, test work and feasibility studies, through design and construction of mine, mine facilities and process plant.

We'll be happy to provide detailed facts on WKE's Mineral Engineering Services plus specific information on minerals or metals.

WKE

WESTERN-KNAPP ENGINEERING CO.
SAN FRANCISCO • New York • Chicago • Hibbing
Building for the Future—in a World of Industries

GET REAL PRODUCTIVITY—GET A GM DIESEL ENGINE

Like to cut your fuel costs and save over two thousand dollars per overhaul?

That's what is being done by R. P. Waldie, General Manager of Rocky Mountain Mining and Transport Company, uranium ore haulers in Grants, New Mexico.

Here's what he has to say about this Diamond T, eighth GM Diesel powered unit to be added to his fleet.

"GM Diesel engines cost us less to operate and average less time in the shop than any other power plant we have in the fleet. We're averaging 5.5 m.p.g. with this unit compared to 4.5 m.p.g. on our trucks that are powered with another make Diesel."

Rocky Mountain Mining and Transport hauls uranium ore from mine to mill. They operate at an altitude of 6200 feet . . . haul up to 60,000 lbs. GCW over tough grades in temperatures as low as 14° below zero.

When it comes to overhaul costs Mr. Waldie says, "We're getting an additional 60,000 to 100,000 miles between overhauls on our GM Diesel powered rigs. Also, we figure it costs us about $1500 to do a major on a GM Diesel and about $3700 on the other make. We save on operating and overhaul costs and get more time on the road."

You'll find your productivity and profits climbing, too, if you put GM Diesels to work for you. See your GM Diesel distributor, or write direct for more information.

GM DIESEL

DETROIT DIESEL ENGINE DIVISION,
GENERAL MOTORS, DETROIT 28, MICH.

In Canada: GENERAL MOTORS DIESEL LIMITED, London, Ontario
Parts and Service Worldwide

GM DIESEL ALL-PURPOSE POWER LINE sets the standard of Diesel productivity

CYANAMID

REAGENT NEWS

"ore-dressing ideas you can use"

SUPERFLOC 16 Flocculant reduces thickener overflow loss by 92.2%...*

recovers many times its cost for Non-Metallic Mineral Producer

At this non-metallic mineral operation, loss of solids in the overflow of a 25' diameter thickener averaged 19 tons per day. Addition of only 4 lb. per day of SUPERFLOC 16 Flocculant as a 0.1% water solution cut overflow losses to a record low of 1.5 tons per day. While specific gravity of the underflow dropped 10% (75% to 65%) with use of flocculant, there has been no decrease in the throughput and fluidity of thickener underflow is much improved. Values recovered are worth many times the $6.56 daily cost of SUPERFLOC 16.

Previous comparative mill tests showed SUPERFLOC 16 Flocculant to be more effective in cutting overflow losses than other flocculating agents and at ¼ the daily cost of less effective agents.

If you have not yet tested SUPERFLOC 16 Flocculant as a settling agent and filter aid, write our nearest office for a test sample and technical data on its use.

*Trademark

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Johannesburg, Union of South Africa

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Of. 7, Lima, Peru

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High Explosives
Permissibles
Seismograph Explosives
Blasting Agents
Blasting Caps
Electric Blasting Caps
Blasting Accessories

AMERICAN CYANAMID COMPANY
EXPLOSIVES AND MINING CHEMICALS DEPARTMENT

CYANAMID INTERNATIONAL—*Mining Chemicals Department*
Cable Address:—Cyanamid, New York

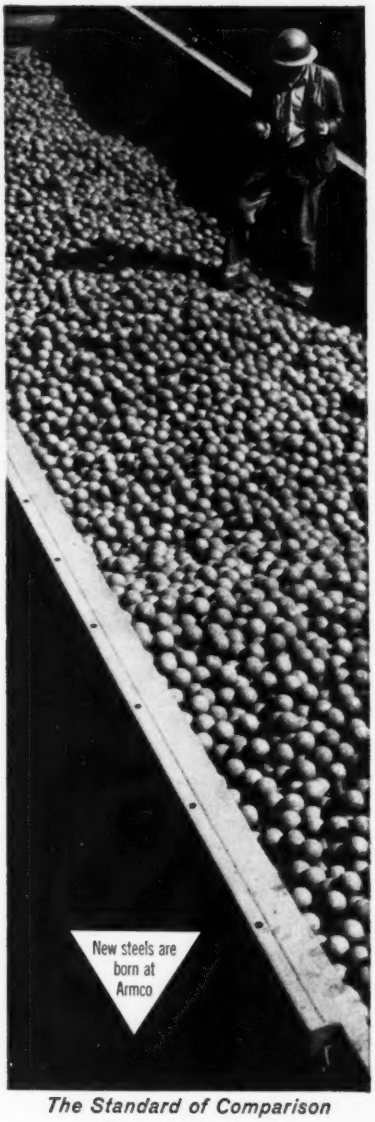
30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

consistently

UNIFORM

grinding economy

SHEFFIELD
ARMCO
MOLY-COP
COPPER-MOLYBDENUM-ALLOY
Grinding Balls



Ball after ball, charging after charging, carload after carload—uniformity is a sure thing with Moly-Cop Balls. Uniformity of toughness and hardness. Uniformity of fine, dense grain structure. Uniformity of longer service, less down time and better grinding at lower cost. That's the result of Sheffield quality control in alloying, forging and heat treating—from furnace to finished ball.

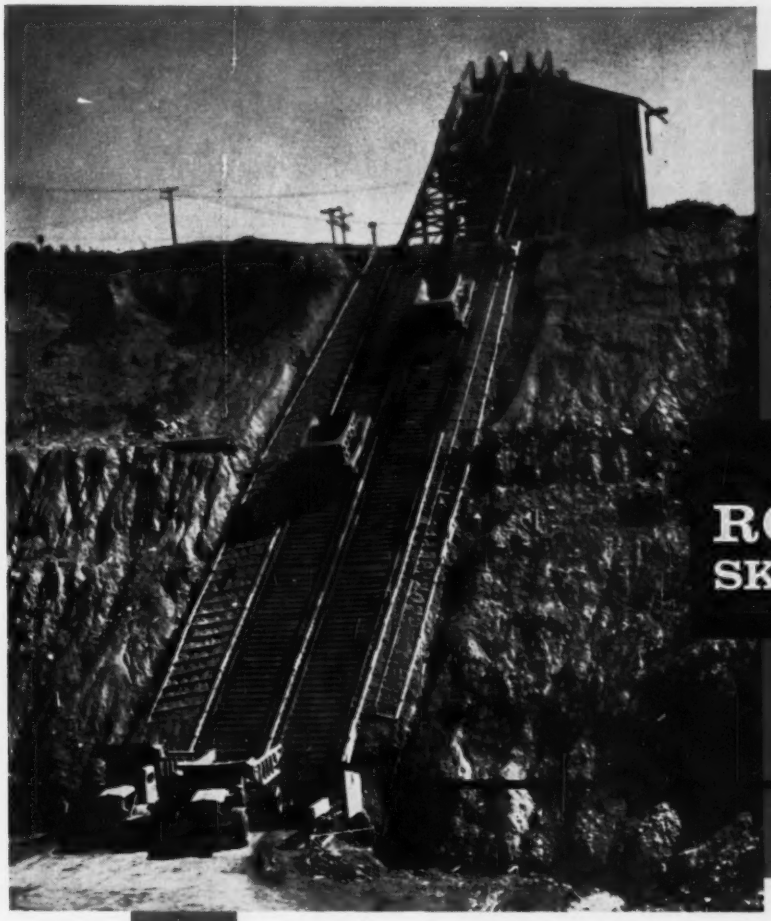
The Standard of Comparison Around the World

SHEFFIELD DIVISION

Sheffield Plants in Kansas City, Tulsa and Houston

ARMCO STEEL CORPORATION

OTHER DIVISIONS AND SUBSIDIARIES: Armco Division • The National Supply Company • Armco Drainage & Metal Products, Inc. • The Armco International Corporation • Union Wire Rope Corporation • Southwest Steel Products



Elevate materials at LOWEST COST PER TON with ROCKOVER SKIP SYSTEMS

IN USE SINCE 1949

The ROCKOVER SKIP SYSTEM has proven to be the most economical method to elevate materials from open pits. It uses the shortest and fastest hauling route, has the lowest operating and maintenance costs and requires no large investment in parts and standby equipment.

Rockover Skip Systems require no expensive wide roads for pit access and require a minimum of personnel . . . are flexible to follow pit bottom as operations go deeper . . . haul either waste or ore at anytime . . . may be loaded at any desired bench and require no sizing equipment in the pit.

NICO

SKIPS FROM 15 TO 50 TON CAPACITIES AVAILABLE

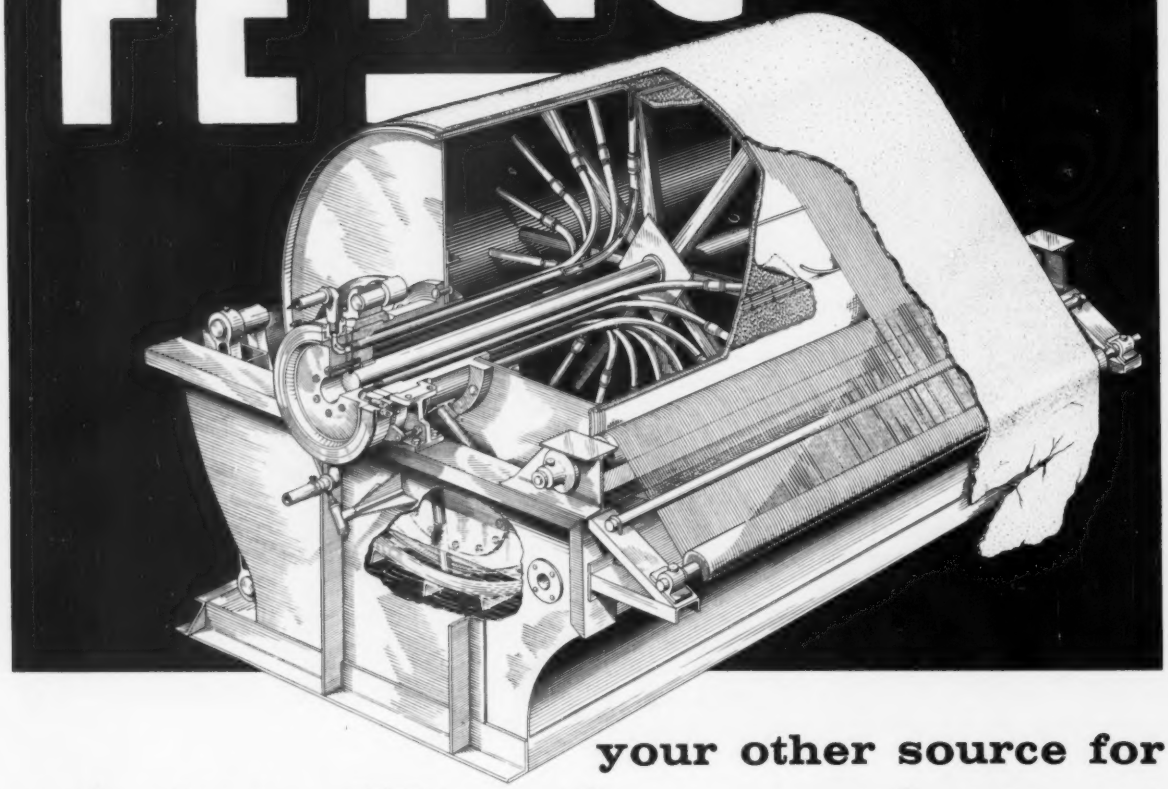
Write for illustrated brochure.

NATIONAL IRON COMPANY

50th Avenue West and Ramsey Street • Duluth 7, Minnesota

Subsidiary of Pettibone Mulliken Corporation, Chicago 51, Illinois

FE INC®



your other source for

mining filtration equipment

HERE IS WHY FE INC® MERITS YOUR CONSIDERATION

FEINC *originated* and *developed* the string discharge filter.

The drum on a FEINC Filter turns on a *heavy, solid steel* center shaft *not found* on most filters. This feature alone can protect against costly drain line breaks and weld cracks. FEINC means *ruggedness.*

With over 35 years total experience, FILTRATION ENGINEERS has been a member of American Machine and Metals, Inc., internationally recognized family of LIQUID-SOLIDS SEPARATION SPECIALISTS for 3 years. This family includes TOLHURST® Centrifugals, NIAGARA® Pressure Filters and FEON® Filter Fabrics. FEINC users benefit from this concentration of filtration experience from many fields.

SEND US YOUR INQUIRY. Tell us your problem or tell us your requirements. We offer both complimentary laboratory test and pilot plant rental services. Compare our recommendations and quotations on vacuum or pressure rotary drum (scraper, string or roller discharge), horizontal table or precoat filters. (Disc type filter available *soon.*) Next time, before you decide . . . *investigate* FEINC. Write for Bulletin 103.

FILTRATION ENGINEERS

A DIVISION OF

American Machine and Metals, Inc.

EAST MOLINE, ILLINOIS

FEON®

FILTER FABRICS ARE TAILORED FOR THE JOB

Filter fabric construction details are not enough. Correct design and fit affect filter media life and performance. FEON manufactures correctly designed and fitted . . .

ANODE BAGS AND DIAPHRAGMS

CENTRIFUGAL LINERS

DUST TUBES

PLATE AND FRAME FILTER COVERS

PRESSURE LEAF DISCS

PRESSURE LEAF SACKS

VACUUM DISC SECTOR BAGS

VACUUM DRUM COVERS, BELTS, BLANKETS

YARDAGE PRODUCED OR SLIT TO WIDTH

Send us your inquiry

Frank F. Kolbe, Chairman of the Board of The United Electric Coal Companies, developer of the "big wheel."

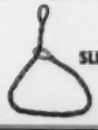
The "big wheel" has muscles of Yellow Strand Wire Rope

This is the Kolbe Wheel Excavator now in operation at United Electric Coal Co.'s Cuba Mine near Canton, Illinois. It is the largest earthmoving machine ever built in America. The giant digs and moves 3,500 cu. yds. of overburden per hour, in a continuous stream, a maximum distance of 420 feet.

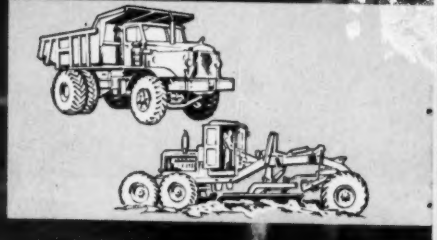
Muscles for the business end — the giant wheel — are Yellow Strand Wire Rope. It was specified for raising and lowering ladder and stacker, and must carry the 476,000 lb. wheel and ladder. It is subjected to the impact of 1½ ton boulders dropping 10′ or more, and the constant vibration of continuous operation.

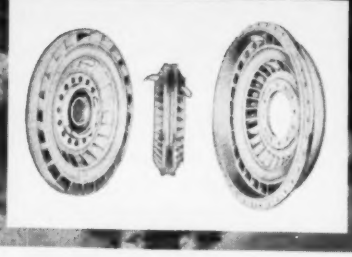
It will pay you to entrust your critical loads to Yellow Strand, too! Contact your B & B Distributor for complete details. Broderick & Bascom Rope Co., 4203 Union Blvd., St. Louis 15, Missouri.

Yellow Strand®

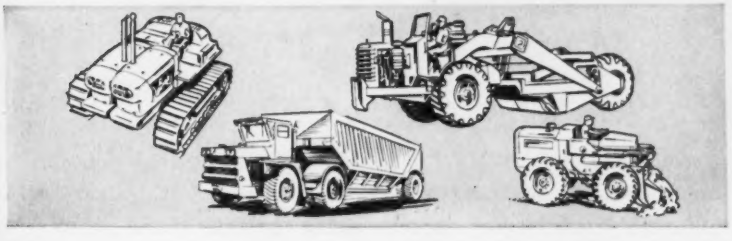


What's it costing





you to keep the clutch pedal?



THE ACTUAL FIGURES are on your own cost sheets: Engine-disconnect clutch replacements at $800 or more each year (plus expensive downtime)—too-frequent overhauls of overtaxed engines at $1,200 to $1,500 each—constant repair bills for shock-load-damaged axles and drive lines —$1,500 to $2,000 in equipment damage every time you train a rookie driver.

What Can You Do About These Costs?

Now mark this: When your equipment has Allison TORQMATIC DRIVES, you eliminate these costs—or cut them to amazing new lows. Engine-disconnect clutch repairs are ended, so is shock-load damage. New drivers practically never make a costly shifting mistake. You save one engine overhaul out of three.

So you're money ahead no matter how good your present clutch-pedal equipment is—or how skillful the men who operate it. For TORQMATIC takes over the clutching job—adjusts power output to every change in load demand—protects your whole power train every working minute.

Can You Afford to Pay the Penalty?

Can you afford, then, to pay the penalty of owning old-fashioned clutch-pedal equipment—especially when it means competing against other owners who looked past first cost and are now enjoying TORQMATIC savings?

Remember, no other heavy-duty hydraulic transmission has been so thoroughly battle-tested over the years. And you can get it in over 100 makes of equipment of most every type. See your equipment dealer—or write Allison for the full story.

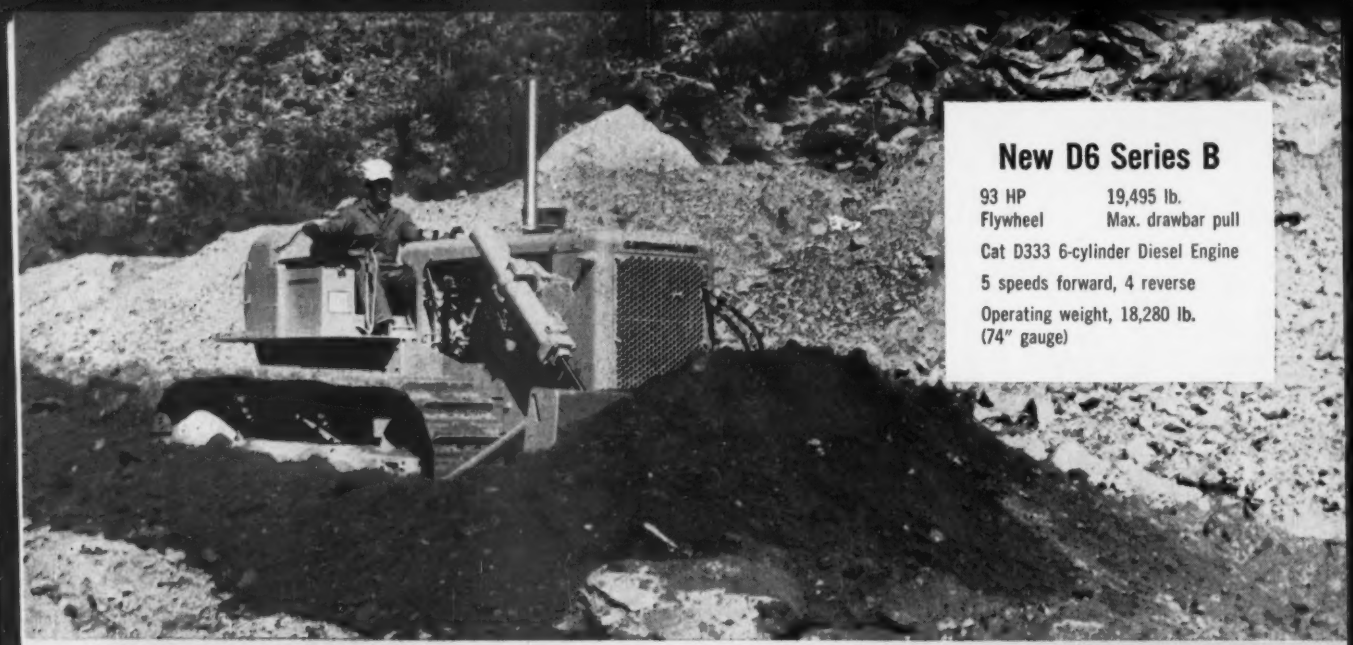
ALLISON DIVISION OF GENERAL MOTORS
Indianapolis 6, Indiana
In Canada: General Motors Diesel Ltd., London, Ontario

Allison TORQMATIC

TORQMATIC® DRIVES

THE MODERN DRIVE FOR MODERN EQUIPMENT

Built stronger to last longer—Allison casts its converter for extra strength, greater precision —and the converter is *integrated* with the transmission for a neat, easily serviced installation.



New D6 Series B

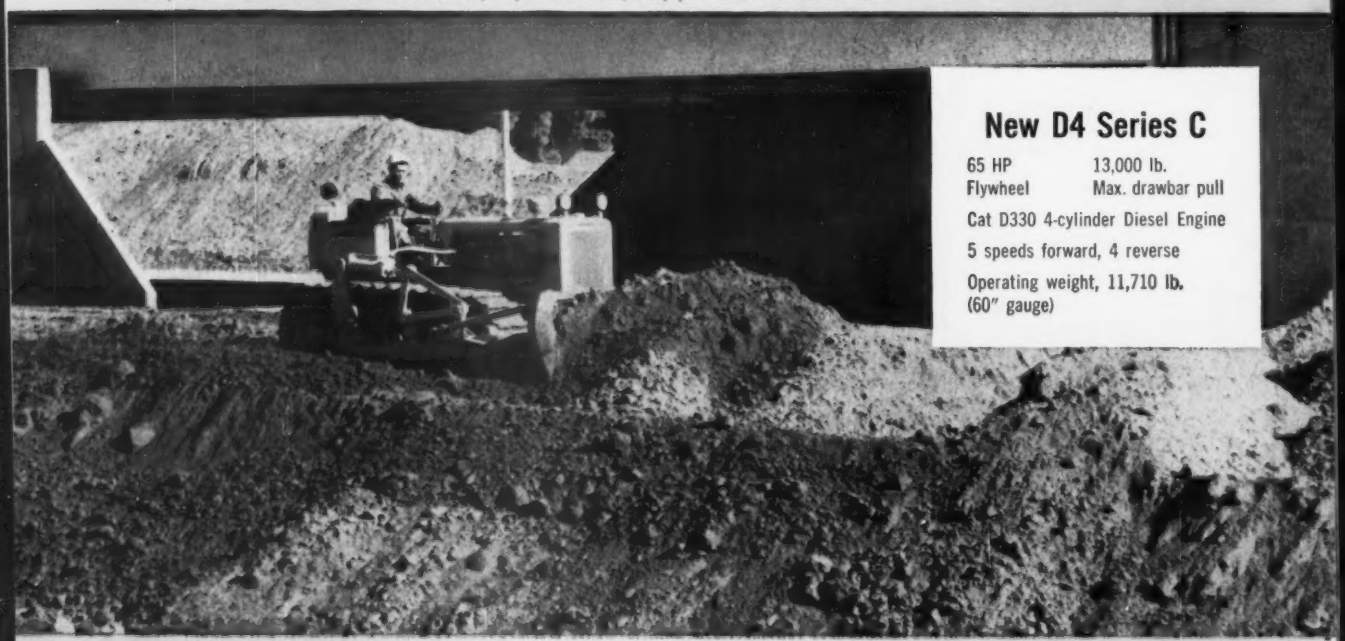
93 HP Flywheel — 19,495 lb. Max. drawbar pull

Cat D333 6-cylinder Diesel Engine

5 speeds forward, 4 reverse

Operating weight, 18,280 lb. (74" gauge)

RUGGED MATCHED ATTACHMENTS for the D6 and D4 include Bulldozers, Tool Bar, Scraper, Rock Rakes, Winches, K/G Blade, Rippers and others.



New D4 Series C

65 HP Flywheel — 13,000 lb. Max. drawbar pull

Cat D330 4-cylinder Diesel Engine

5 speeds forward, 4 reverse

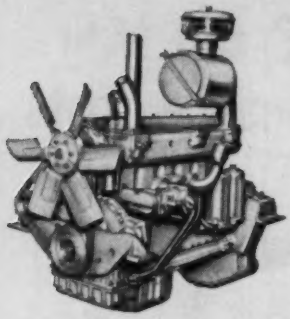
Operating weight, 11,710 lb. (60" gauge)

IMPROVED STARTING ENGINE for both tractors has recoil starter for fast starts. Also 12-volt in-seat starting available. 24-volt direct electric starting optional.

CATERPILLAR ANNOUNCES the

completely redesigned for faster and greater production

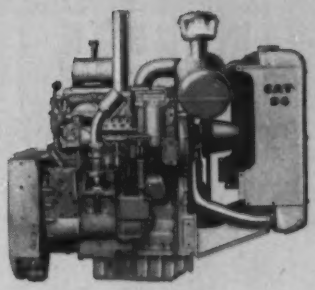
There's no time like now to upgrade your equipment spread. These two new tractors not only look different—they are different. Each, in its own class, answers your needs for higher production and greater operating economy. Some of their important new features are described on these pages. In addition to these improvements, each machine provides other famous Caterpillar features... the dry-type air cleaner,



D6 93 HP 6-cylinder Engine
Maximum drawbar pull, 19,495 lb. The D333 Engine provides power with dependability for a long life of economical operation.

New Caterpillar Diesel Engines deliver 25% more lugging ability

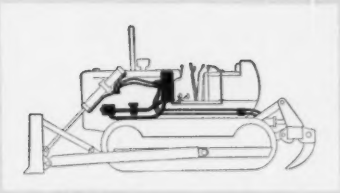
For the D6 and D4, two completely new Cat Diesel Engines. 25% more lugging ability. New compactness with new ruggedness. Famous Cat fuel injection pumps in new, easily serviceable housing. New direct acting governor that makes quick fuel adjustments, picks up loads fast. New, improved gasoline starting engine.



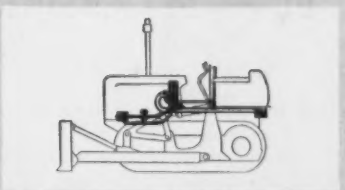
D4 65 HP 4-cylinder Engine
Maximum drawbar pull, 13,000 lb. New design of the D330 results in smooth, vibration-free performance in all speed ranges.

New integral hydraulic systems put more power where you need it

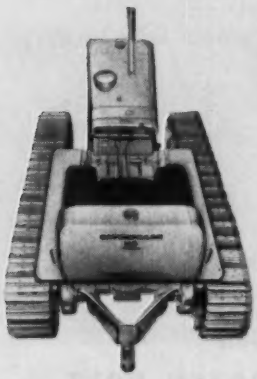
More work power at the tools—that's one of the big advantages of these new Cat hydraulic systems. Under-the-hood mounting of tank, pump and valves permits convenient routing of hydraulic lines to bulldozer or implement cylinders, frees front and rear for mounted equipment. Center-pivoted cylinder mounting on D6 gives increased blade lift/drop range for greater production. Hydraulic control system provides hand control for bulldozer and/or ripper, foot control for tilt cylinder on D6.



D6 Integral Hydraulic System
No. 165 Hydraulic Control for bulldozer
54 GPM Pump—1500 PSI
No. 143 Hydraulic Control for No. 6 Tool Bar
29 GPM Pump—1700 PSI



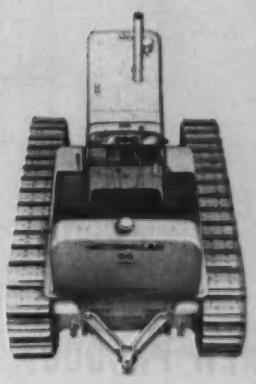
D4 Integral Hydraulic System
No. 143 Hydraulic Control with:
29 GPM Pump—1700 PSI for bulldozers
17 GPM Pump—1700 PSI for tool bars



D6 operator's compartment

New operator convenience and comfort in co-ordinated compartments

The cockpits are all new. Controls are co-ordinated to make one motion flow into the next, reducing hand movements and speeding every operation. Forward-reverse lever (new on the D4) is next to the operator's right hand to speed 'dozer cycle times. Short-travel transmission speed selector shifts gears easily, quickly. Boosters for steering clutches save muscles . . . increase efficiency.



D4 operator's compartment

New D4 Series C and D6 Series B Tractors

hydraulic track adjusters, lifetime lubricated track rollers, the oil clutch, the forward-reverse lever. Your Caterpillar Dealer will be happy to give you the complete facts about both the new D6 and the new D4 and demonstrate them on any of your jobs. The tougher, the better.

Caterpillar Tractor Co., General Offices, Peoria, Illinois, U. S. A.

CATERPILLAR

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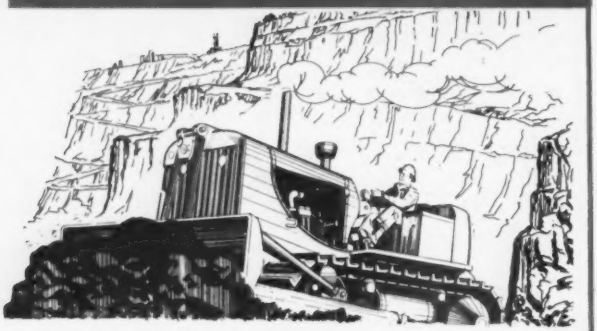
BORN OF RESEARCH
PROVED IN THE FIELD

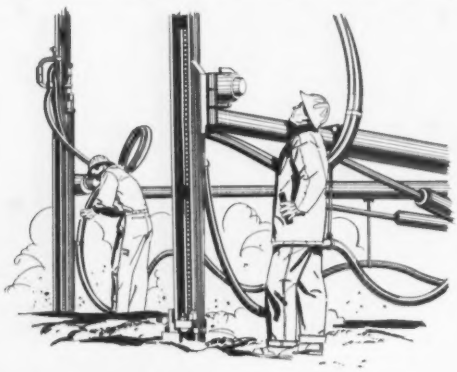
LUBE LOGIC

these TIPS can trim your maintenance costs



DON'T LET ENGINES FOUL UP!

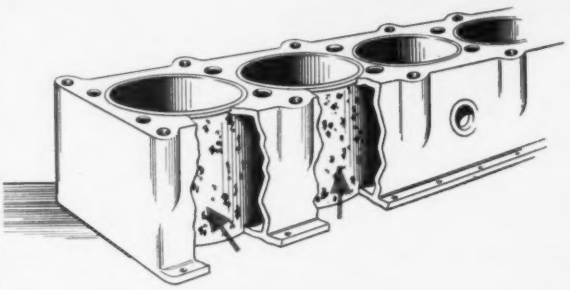
If the fuel injector on a diesel drifts and dribbles, some of the fuel will end up in the crank case. Also there will be plenty of smoke—and probable engine trouble. The injector should be fixed immediately—but if it can't be, start shortening drain periods to remove the contaminated oil-fuel mixture. Also, use an oil with full detergent and dispersion properties to keep other undesirable products out of the engine.



NEW PRODUCT FOR ROCK DRILL COUPLINGS

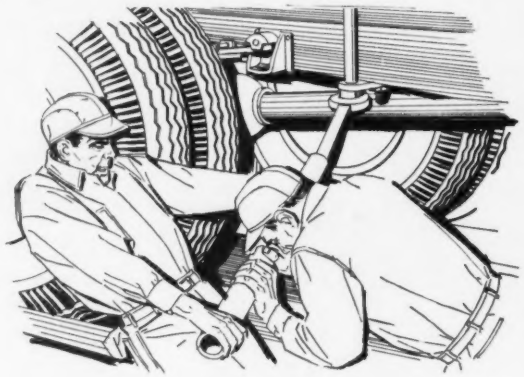
Actually it's an old friend, Marfak Heavy Duty #2, in a new application. According to the raves from customers who've tried it, the lubricant works better on rock drill couplings than anything they've ever used.

Your Texaco Lubrication Engineer is your best source for money-saving maintenance ideas—and for a Simplified Lubrication Plan tailored to your operation. Don't forget that "Lubrication is a major factor in cost control." Texaco Inc., 135 East 42nd Street, New York 17, New York.



NEW WAY TO STOP CYLINDER CAVITATION

High pressure cooling systems in use in most super-charged diesels are subject to coolant aeration. This aeration can cause cavitation, leading to cylinder liner corrosion-erosion, unless a rust preventative is added to the water. A good anti-freeze will do the job in winter—but in summer 1% to 2% Texaco Soluble Oil C will do a fine job. (Remember to flush out before you add anti-freeze again.)



HOW TO AVOID THAT FROZEN BOLT

Ever spend hours fighting a U-bolt that's decided to corrode itself tight? It's an unforgettable experience—and one you can avoid by just digging up the price of a pack of gum. All you need is a dash of Texaco Threadtex to keep that bolt rust-free. Ask your Texaco man to tell you about it.

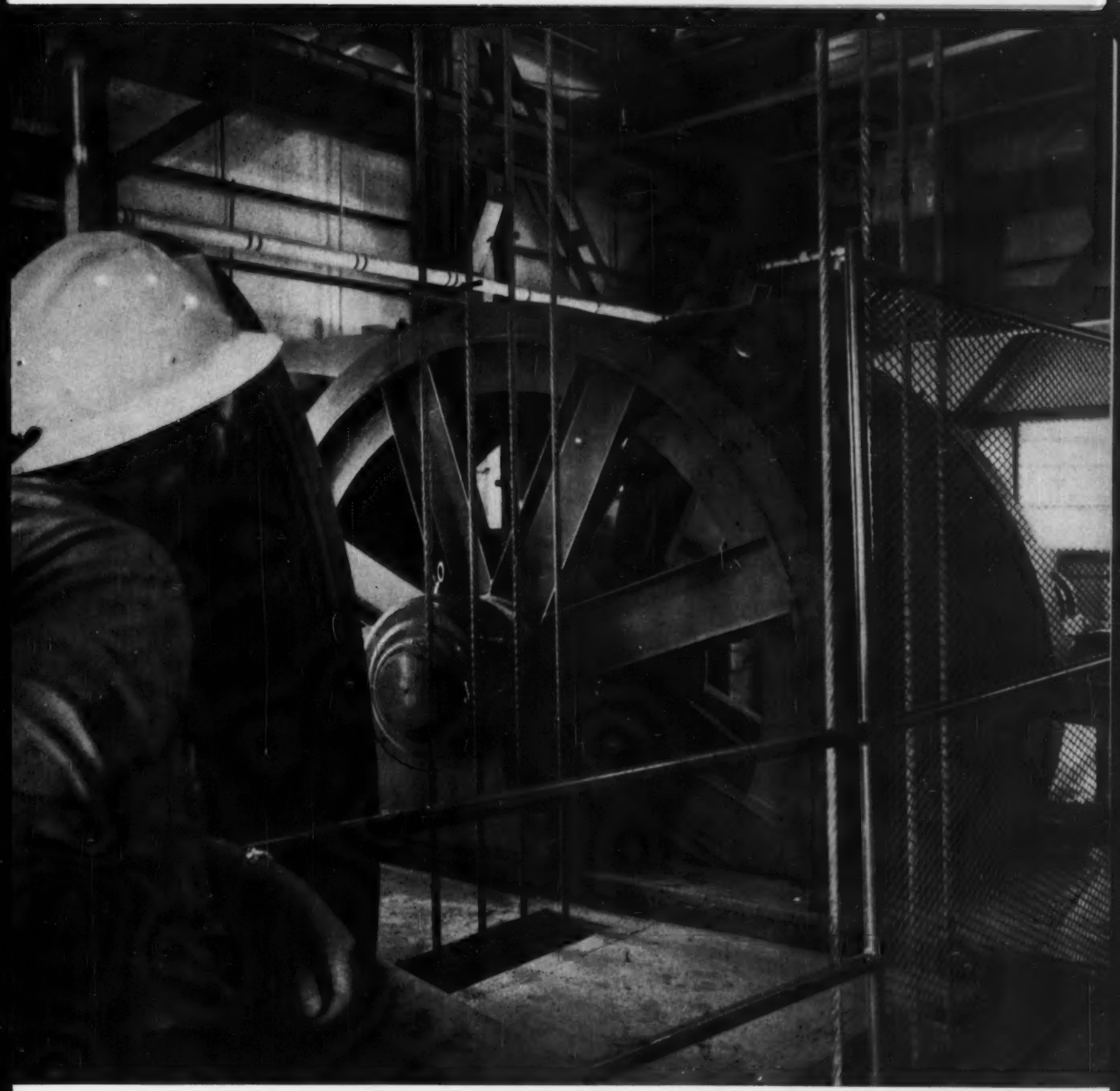
TUNE IN: TEXACO HUNTLEY-BRINKLEY REPORT, MON. THRU FRI.—NBC-TV

TEXACO

Throughout the United States

Canada • Latin America • West Africa

Shown are two 6 cu. yd. P&H Model 1600 Mining Excavators



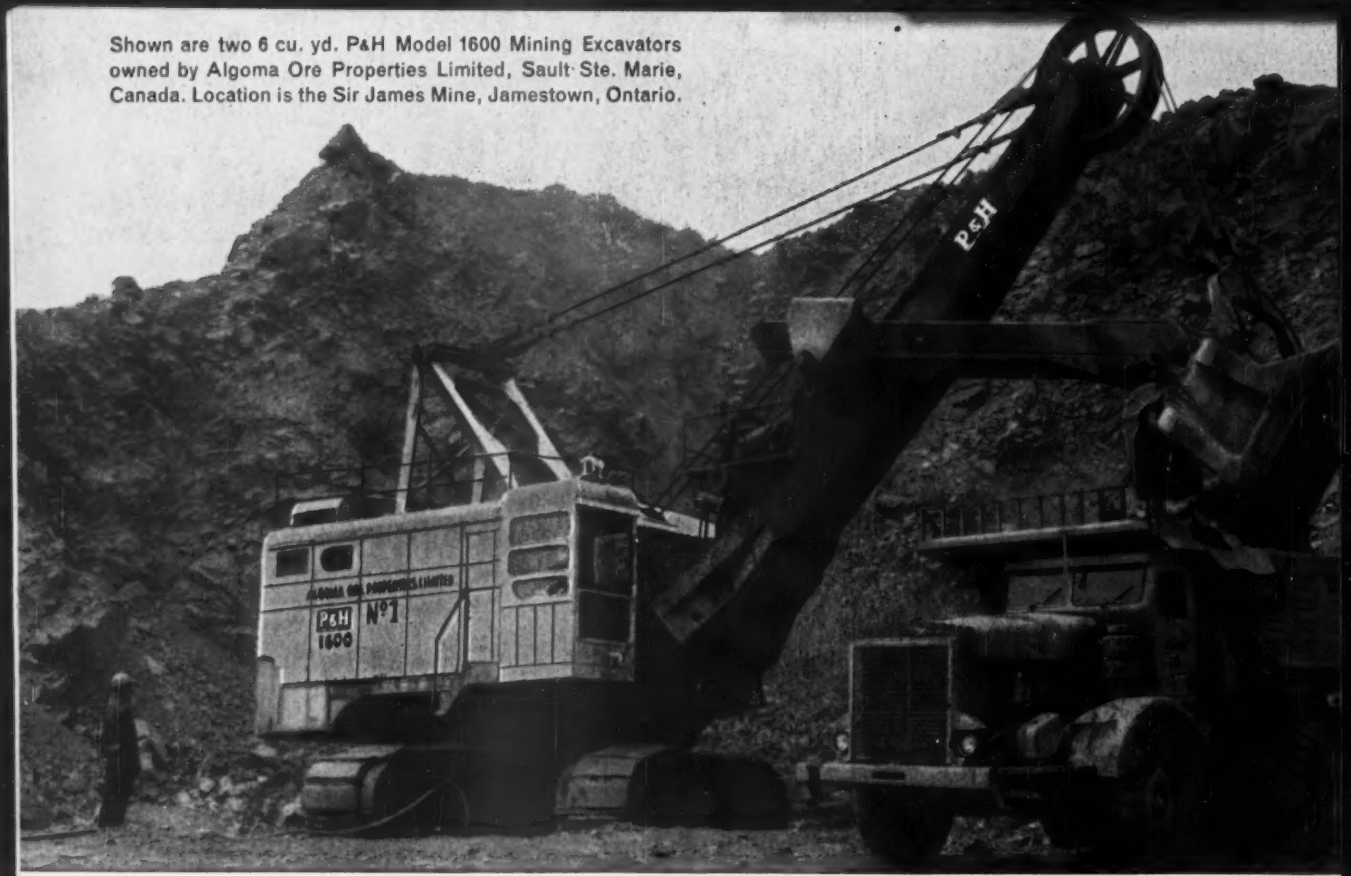
Bethanized Coating Protects Wire Rope in Koepe Hoist—You're looking at Bethlehem Wire Rope serving on a Koepe hoist at the Cliffs Shaft Mine of Cleveland-Cliffs Iron Company. This installation calls for something special in rope service, because lubricants on the operating ropes have to be held to the minimum. And conditions in the shaft are "wet." The rope (a flattened strand for the hoist cables and a special non-rotating type for the tail lines) has been in service for months, thanks to the outstanding corrosion-resistance of the bethanized coating. This is a heavy-duty armor which protects the steel wires with a smooth, uniform layer of pure zinc.

Bethlehem Wire Rope made with bethanized wire has another important advantage in mining applications due to the ductile zinc coating serving as an internal lubricant for the rope. Bethlehem produces wire rope in a variety of bethanized coating weights, so as to meet virtually any type of operating condition.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA. *Export Distributor: Bethlehem Steel Export Corporation*

Mill depots and distributors from coast to coast stock Bethlehem Wire Rope

BETHLEHEM STEEL



Shown are two 6 cu. yd. P&H Model 1600 Mining Excavators owned by Algoma Ore Properties Limited, Sault Ste. Marie, Canada. Location is the Sir James Mine, Jamestown, Ontario.

AT ALGOMA ORE PROPERTIES,

LTD.

One P&H always sells another because...

P&H "PROFIT·TONS" reduce loading costs in hardest digging

Up to 30% higher bail pull for more uniform dipper speed in the pile—faster swing—exceptional physical strength of P&H welded construction—greater job availability all add up to as much as 10% more production, lower loading cost per ton and *more net profit* for owners of P&H Electric Mining Excavators on their hardest digging assignment.

P&H "Profit-Tons" are the end product of these *exclusive* P&H design principles:

MAGNETORQUE® . . . the most productive digging motion drive known for electric excavators. This patented P&H hoist drive electro-magnetically transmits the full digging power of an A.C. hoist motor direct to the dipper *without motor generator set conversion to D.C. current.* It gives higher bail pull, greater dipper fill factor and automatic impact protection to the digging machinery.

ELECTRONIC CONTROL . . . this patented P&H control accomplishes the quickest work motion reaction time known on electric shovels. Control maintenance expense is reduced as much as 80% by elimination of all moving parts for a completely closed circuit system.

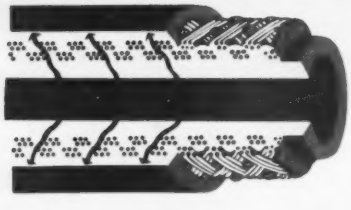
In addition, with P&H—and only with P&H—do you get the service assurance of single source responsibility. P&H manufactures their own electrical as well as mechanical components—*designed specifically for electric excavator service.* Write Dept. 607A, Harnischfeger Corporation, Milwaukee 46, Wisconsin.

HARNISCHFEGER
Milwaukee 46, Wisconsin

P&H

P&H LINE:
Electric Excavators: 3¼ through 10 yds.
Diesel Excavators: ½ through 3½ yds.
Truck Cranes: 10 through 80 tons

P&H equipment is also manufactured in Australia, Brazil, Canada, Germany and Japan.



"MORE USE PER DOLLAR"

Rubber tie-gum penetrates Homoflex braided plies to provide an inseparable tube-to-cover bond. More flexible and lighter weight than any hose for equal pressure.

R/M HOMOFLEX HOSE HANDLES EASIER...LASTS LONGER

Homoflex Air Hose is mandrel-made with *no* pre-set twist—it coils and uncoils freely in *any* direction *without* kinking! It's the easiest handling hose you can use with air drills. Exclusive Homoflex construction makes strength member and tube virtually inseparable, assures long, trouble-free service life. Uniform inside and outside diameters permit faster, easier, *safer* coupling . . . faster, fuller flow.

Strong, light weight, and "flexible as a rope", Homoflex Air Hose adds up to real labor and cost savings on the toughest jobs. Homoflex H.D. Air Hose is also available for extra heavy duty and *with yellow cover stripe* for visibility; also in type for water in mine use.

- **SUPER STRONG**
- **PRECISION BUILT**
- **LIGHT WEIGHT**
- **FLEXIBLE AS A ROPE**

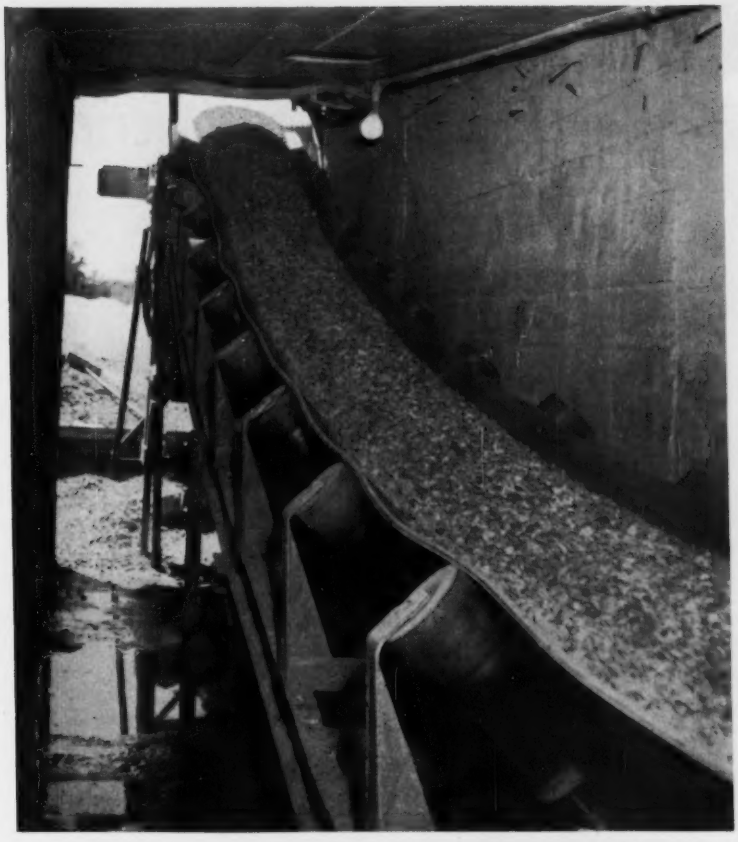
Write for Bulletins M610 and M694.

RM-1017

RAYBESTOS-MANHATTAN, INC.
MANHATTAN RUBBER DIVISION, PASSAIC, NEW JERSEY

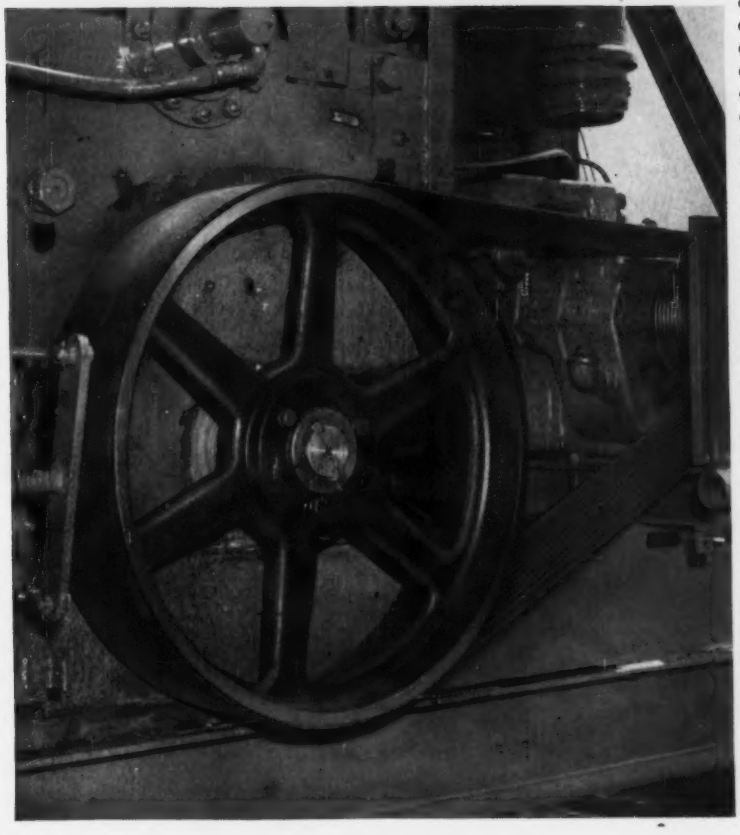
RM

ENGINEERED RUBBER PRODUCTS ..."MORE USE PER DOLLAR"



RAY-MAN CONVEYOR BELT *Engineered for 45° Idlers*

You can now get up to 60% greater hauling capacity—save up to 20% on conveyor costs—as compared to using regular 20° idlers. Ordinary ply belts are too stiff and boardy to do the job—Ray-Man's exclusive flexible construction and built-in stress compensation is *guaranteed* to take the sharp angle of 45° idlers *without* ply or cover separation at the hinge line. Learn how Ray-Man Conveyor Belt opens up a whole new era of conveyor design . . . permitting larger loads . . . narrower conveyors —assuring longer cover wear, lower handling costs! Write for Bulletin M303.



CONVERT TO R/M POLY-V® DRIVE FOR MORE POWER IN LESS SPACE... *with Reliability*

- SINGLE UNIT V-RIBBED DESIGN
- ELIMINATES BELT "MATCHING" PROBLEMS
- MAINTAINS GROOVE SHAPE
- CONSTANT PITCH AND SPEED RATIOS
- LESS WEAR ON BELT AND SHEAVES
- COMPLETE CONTACT-PRESSURE

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R/M Poly-V* Drive is the smoothest and coolest running —*longest wearing* drive you can install. Discuss your application with an R/M Distributor . . . or write for Poly-V* Drive Bulletin M141.

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engine power
BY CATERPILLAR

How excavator repowering can be simplified

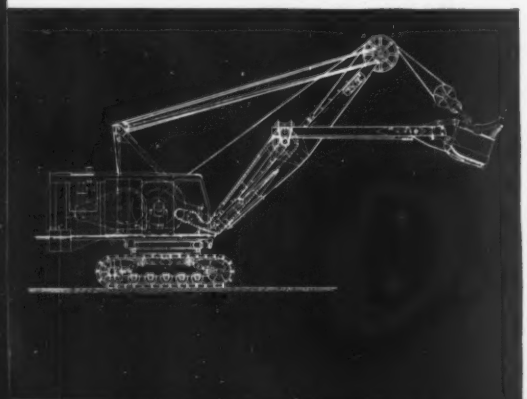
OFTEN a limited engine selection can make the job of repowering an excavator seem complex. It's true that an incorrect choice can make revamping costly. Adapting a poor choice can tie up equipment when it should be working.

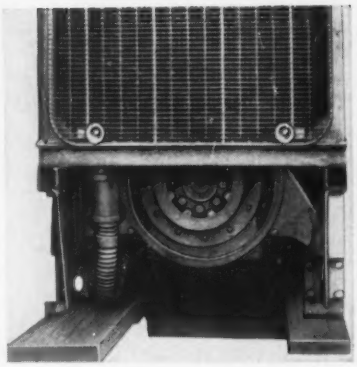
Caterpillar Engines have simplified repowering and have given equipment owners greater profit for over 25 years. Caterpillar makes a complete range of basic engine models from 50 HP to 730 HP requiring no extensive equipment redesign to repower a wide range of machines. Cat Diesels are planned to meet any repowering need . . . mobile . . . stationary . . . mechanical . . . electric . . . 50 or 60 cycle . . . combinations of mechanical and electric . . . natural gas engines in 7.5:1 and 10.5:1 compression ratios. And these engines are available with power transmission for *your* equipment.

When you get a Caterpillar Engine you get fast delivery. Repowering time is kept to a minimum. And you're sure to get the right engine for your machine, hence you're sure of getting improved performance. Repowering returns are high and usually come fast when you choose a Caterpillar Engine.

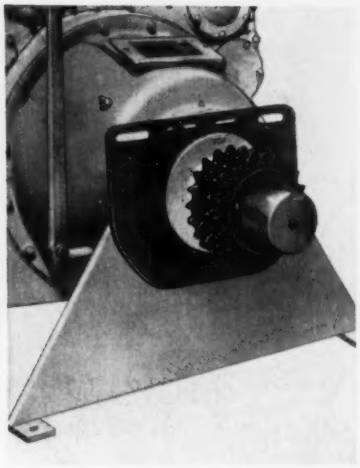
An experienced Caterpillar Dealer Engine Specialist can help you with repowering. He'll analyze your specific power needs. He'll make recommendations that can increase your machine's profitability. And he'll supervise installation.

For more information write for the "Construction Equipment Repowering Packet" which outlines the many avenues of repowering profitability.

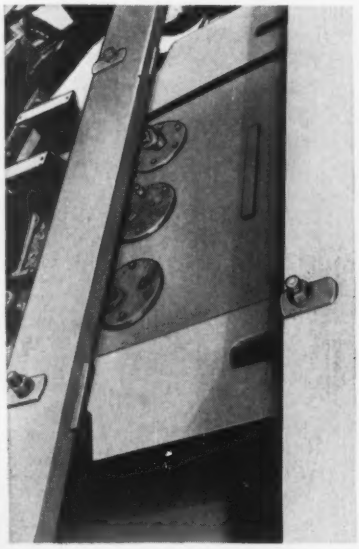




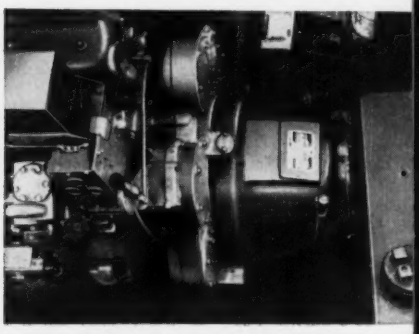
Photos show how easy repowering actually is with Cat Engines. A standard Caterpillar arrangement was selected for this shovel and set at 950 RPM to deliver 263 HP. The engine replaced had produced 215 HP.



This is the clutch with sprocket drive and shaft support plate. Bracket was welded onto chain case to hold engine and case rigid. The radiator is 7" from the side of cab.



Engine was mounted on two 10", 20 lb. channels. Channels were cut to fit, allowing sliding room for clutch removal. Bolt holes were cut for base and engine mounting. Slight modification was done to chain case to clear end of stub shaft. A plug opening was made for greasing the clutch pilot bearing.



Conversion completed. The increased production, minimized downtime convinced owner to repower two additional machines.

CATERPILLAR

Engine Division, Caterpillar Tractor Co., Peoria, Ill., U.S.A.

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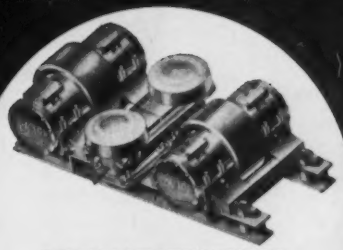

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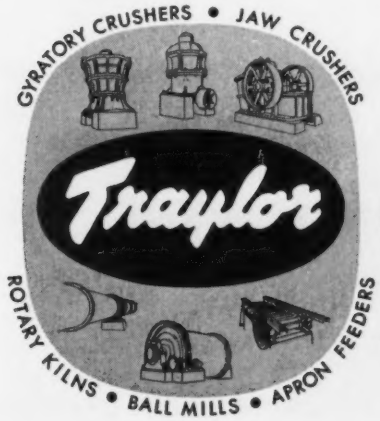

The outstanding roller support insures easy alignment, continuous operation and low maintenance of kilns. Traylor Rotary Kilns have all welded steel shells, feed and discharge end seals, heat recuperating chain systems for wet process kilns, improved kiln feeders, drives and many other reasons why a Traylor Kiln can do your job better. Write for Bulletin No. 1115 today.

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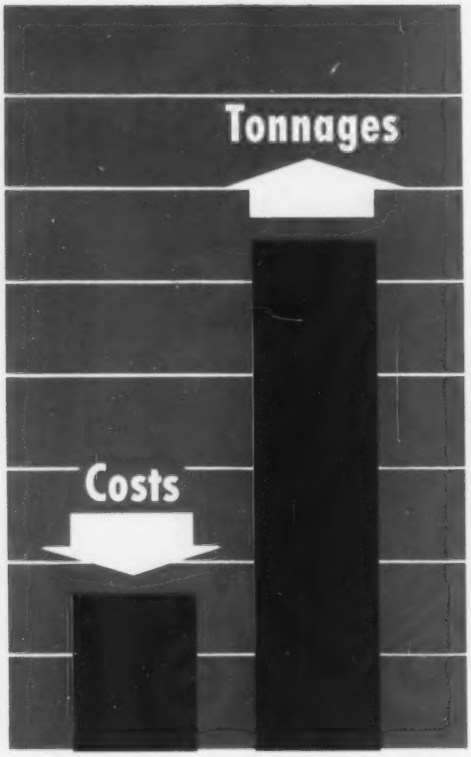

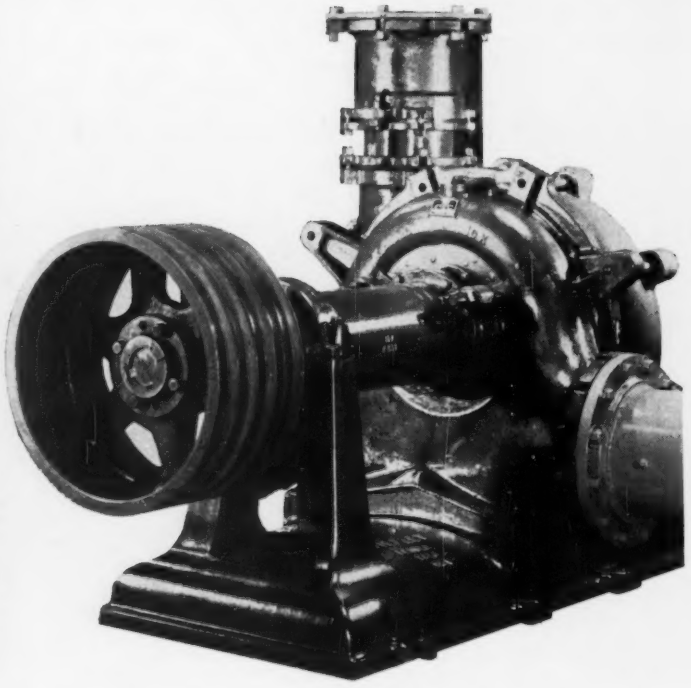

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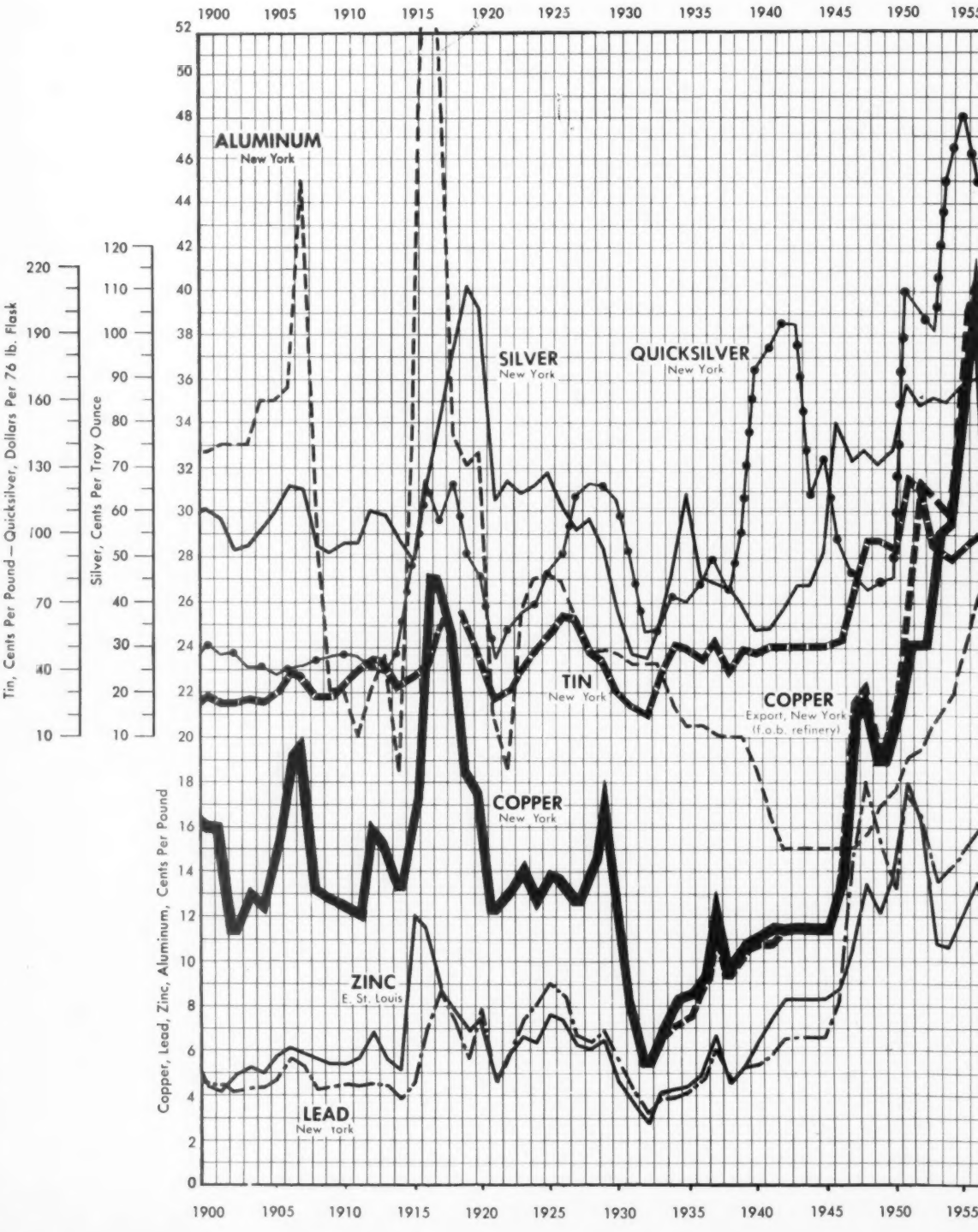
Annual Averages— 1899-1959



Metal Prices

Journal and E&MJ Metal and Mineral Markets

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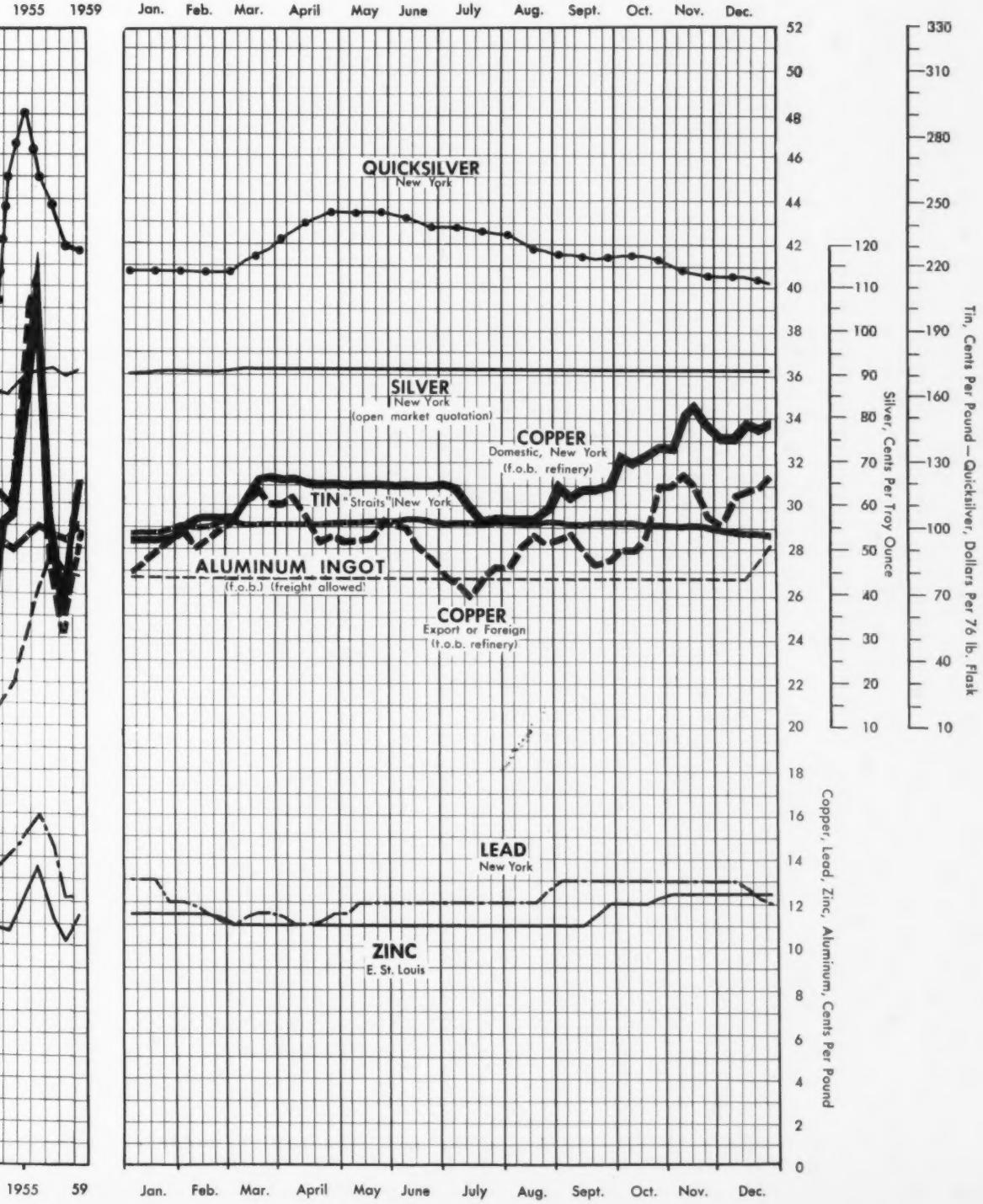
Weekly Averages— 1959



E & M J Annual Average Metal Prices—1898 to 1959

Year	COPPER (a) Domestic Refinery	COPPER Foreign Refinery	LEAD Common N. Y.	ZINC Prime Western (b) E. St. Louis	TIN (c) N. Y.	SILVER (e) N. Y.	QUICK-SILVER (f) N. Y.	ALUM-INUM Ingot
1898	12.03	.....	3.780	4.570	15.70	58.260	40.70	30.58
1899	16.67	.....	4.470	5.750	25.12	59.580	43.63	32.72
1900	16.19	.....	4.370	4.390	29.90	61.330	51.00	32.72
1901	16.11	.....	4.330	4.070	16.74	58.950	47.00	33.00
1902	11.026	.....	4.069	4.840	26.79	52.160	48.03	33.00
1903	13.235	.....	4.237	5.191	28.09	53.570	41.32	33.00
1904	12.823	.....	4.309	4.931	27.99	57.221	41.00	35.00
1905	15.590	.....	4.707	5.730	31.358	60.352	38.50	35.00
1906	19.278	.....	5.657	6.048	39.819	66.791	40.90	35.75
1907	20.004	.....	5.325	5.812	38.166	65.237	41.50	45.00
1908	13.208	.....	4.200	4.578	29.465	52.864	44.84	28.70
1909	12.982	.....	4.273	5.352	29.725	51.502	46.30	22.00
1910	12.738	.....	4.446	5.370	34.123	53.486	47.06	22.25
1911	12.376	.....	4.420	5.608	42.281	53.304	46.54	30.07
1912	16.341	.....	4.471	6.799	46.096	60.835	42.46	22.01
1913	15.269	.....	4.370	5.504	44.252	59.791	39.54	23.64
1914	13.602	.....	3.862	5.061	34.301(d)	54.811	48.31	18.63
1915	17.275	.....	4.673	13.054	38.590	49.684	87.01	33.98
1916	27.202	.....	6.858	12.634	43.480	65.661	125.49	60.71
1917	27.180	.....	8.787	8.813	61.802	81.417	106.30	51.59
1918	24.628	.....	7.413	7.890	88.750	96.772	123.47	33.53
1919	18.691	.....	5.759	6.988	63.328	111.122	92.15	32.14
1920	17.456	.....	7.957	7.671	48.273	100.900	81.12	32.72
1921	12.502	.....	4.545	4.655	29.916	62.654	45.46	21.11
1922	13.382	.....	5.734	5.716	32.554	67.528	58.95	18.68
1923	14.421	.....	7.267	6.607	42.664	64.873	66.50	25.41
1924	13.024	.....	8.097	6.344	50.176	66.781	69.76	27.03
1925	14.042	.....	9.020	7.622	57.893	69.065	83.13	27.19
1926	13.795	.....	8.417	7.337	65.285	62.107	91.90	26.99
1927	12.920	.....	6.755	6.242	64.353	56.370	118.16	25.40
1928	14.570	.....	6.305	6.027	50.427	58.176	123.51	24.300
1929	18.107	.....	6.833	6.512	45.155	52.993	122.15	24.300
1930	12.982	.....	5.517	4.556	31.694	38.154	115.01	23.787
1931	8.116	.....	4.243	3.640	24.467	28.700	87.35	23.300
1932	5.555	.....	3.180	2.876	22.017	27.892	57.93	23.300
1933	7.025	6.713	3.869	4.029	39.110	34.727	59.23	23.300
1934	8.428	7.271	3.866	4.158	52.191	47.973	73.87	23.300
1935	8.649	7.538	4.065	4.328	50.420	64.273	71.99	20.000
1936	9.474	9.230	4.710	4.901	46.441	45.087	79.92	20.000
1937	13.167	13.018	6.009	6.519	54.337	44.883	90.18	19.917
1938	10.000	9.695	4.739	4.610	42.301	43.225	75.47	30.000
1939	10.965	10.727	5.053	5.110	50.323	39.082	103.94	10.000
1940	11.296	10.770	5.179	6.335	49.827	34.773	176.86	18.691
1941	11.797	10.901	5.793	7.474	52.018	34.783	185.02	16.500
1942	11.775	11.684	6.481	8.250	52.000	38.333	196.35	15.000
1943	11.775	11.70	6.500	8.250	52.000	44.750	195.21	15.000
1944	11.775	11.700	6.500	8.250	52.000	44.750	118.36	15.000
1945	11.775	11.700	6.500	8.250	52.000	51.928	134.89	15.000
1946	13.820	14.791	8.109	8.726	54.544	80.151	98.24	15.000
1947	20.958	21.624	14.673	10.500	77.949	71.820	83.74	15.000
1948	22.038	22.348	18.043	13.589	99.250	74.361	76.49	15.733
1949	19.202	19.421	15.364	12.144	99.336	71.930	79.46	17.000
1950	21.235	21.549	13.296	13.866	95.539	74.169	81.26	17.713
1951	24.200	26.258	17.500	18.000	127.077	89.368	210.13	19.000
1952	24.200	31.746	16.467	16.215	120.473	84.941	199.097	19.410
1953	28.798	30.845	13.489	10.855	95.845	85.188	193.032	20.931
1954	29.694	29.889	14.054	10.681	91.838	85.250	264.386	21.784
1955	37.491	39.115	15.138	12.299	94.735	89.099	290.348	23.668
1956	41.818	40.434	16.013	13.494	101.409	90.826	259.923	26.010
1957	29.576	27.157	14.658	11.399	96.261	90.820	246.978	27.516
1958	25.764	24.123	12.109	10.309	95.127	89.044	229.057	26.890
1959	31.182	28.892	12.211	11.448	102.053	91.202	227.484	26.838

(a) Lake copper 1897–98: domestic market since 1932. (b) New York delivery 1898–1902. (c) 99% in 1897 to 1920, inclusive: Straits quality thereafter. (d) Average for 11 months. (e) New York market. . .. All quotations in cents. per lb, except for silver, which is in cents per troy oz, and (f) quicksilver, which is in dollars per flask of 76 lb. See opposite page and reverse for weekly average prices for 1958.

E & M J Weekly Average Metal Prices—1959

	COPPER		LEAD	ZINC	TIN	SILVER	QUICK-SILVER	ALUM-INUM
	Domestic Refinery	Foreign Refinery	N. Y. Common	E. St. Louis Prime Western	N. Y. "Straits"	N. Y.	N. Y.	99% plus, Ingot
Jan. 7	28.600	26.963	13.000	11.500	98.563	89.917	218.000	26.800
14	28.605	27.570	13.000	11.500	99.000	90.125	218.000	26.800
21	28.620	28.055	13.000	11.500	99.400	90.225	218.000	26.800
28	28.660	28.420	12.000	11.500	99.775	90.375	218.000	26.800
Feb. 4	29.160	28.975	12.000	11.500	100.925	90.375	218.000	26.800
11	29.600	28.265	11.900	11.500	102.075	90.375	218.000	26.800
18	29.663	28.670	11.500	11.500	102.469	90.375	218.000	26.800
25	29.700	28.970	11.143	11.375	103.906	90.500	218.000	26.800
Mar. 5	29.690	29.410	11.000	11.000	104.425	91.025	218.000	26.800
12	30.585	30.225	11.412	11.000	102.750	91.375	221.000	26.800
19	31.440	30.930	11.500	11.000	103.425	91.375	224.000	26.800
26	31.565	30.150	11.500	11.000	102.850	91.375	227.000	26.800
Apr. 2	31.415	30.269	11.400	11.000	102.656	91.375	232.000	26.800
9	31.470	30.500	11.000	11.000	102.775	91.375	236.000	26.800
15	31.275	29.610	11.000	11.000	102.425	91.375	240.000	26.800
22	31.215	28.595	11.231	11.000	102.275	91.375	242.000	26.800
29	31.230	28.810	11.500	11.000	102.525	91.375	245.000	26.800
May 6	31.165	28.470	11.500	11.000	102.650	91.375	245.000	26.800
13	31.175	28.520	11.966	11.000	102.675	91.375	245.000	26.800
20	31.160	28.706	12.000	11.000	103.150	91.375	245.000	26.800
27	31.155	29.255	12.000	11.000	103.450	91.375	245.000	26.800
June 3	31.115	29.435	12.000	11.000	104.250	91.375	243.000	26.800
10	31.155	29.010	12.000	11.000	104.775	91.375	242.000	26.800
17	31.105	28.130	12.000	11.000	104.600	91.375	240.000	26.800
24	31.065	27.495	12.000	11.000	103.800	91.375	239.000	26.800
July 1	31.160	26.760	12.000	11.000	103.375	91.375	238.000	26.800
8	31.010	26.630	12.000	11.000	102.950	91.375	238.000	26.800
15	30.260	25.850	12.000	11.000	102.575	91.375	237.000	26.800
22	29.495	26.885	12.000	11.000	102.150	91.375	236.000	26.800
29	29.560	27.280	12.000	11.000	101.950	91.375	234.000	26.800
Aug. 5	29.555	27.285	12.000	11.000	101.825	91.375	234.000	26.800
12	29.570	28.140	12.000	11.000	101.650	91.375	231.000	26.800
19	29.635	28.790	12.000	11.000	102.350	91.375	229.000	26.800
26	30.030	28.370	12.600	11.000	102.850	91.375	228.000	26.800
Sept. 2	31.185	28.615	13.000	11.000	102.800	91.575	225.000	26.800
9	30.725	28.750	13.000	11.000	102.125	91.375	225.000	26.800
16	30.950	27.980	13.000	11.000	102.275	91.375	224.000	26.800
23	31.010	27.395	13.000	11.401	102.650	91.375	223.000	26.800
30	31.130	27.645	13.000	12.000	102.600	91.375	223.000	26.800
Oct. 7	32.495	27.955	13.000	12.000	103.175	91.375	224.000	26.800
14	32.200	28.035	13.000	12.000	102.688	91.375	224.000	26.800
21	32.470	28.665	13.000	12.000	101.925	91.375	224.000	26.800
28	32.920	30.985	13.000	12.308	101.650	91.375	222.000	26.800
Nov. 4	32.875	31.095	13.000	12.544	101.531	91.375	221.000	26.800
11	34.338	31.685	13.000	12.500	101.375	91.375	218.000	26.800
18	34.825	30.970	13.000	12.500	101.250	91.375	216.000	26.800
25	33.905	29.465	13.000	12.500	100.650	91.375	215.000	26.800
Dec. 2	33.344	29.215	13.000	12.500	100.000	91.375	215.000	26.800
9	33.345	30.500	13.000	12.500	99.550	91.375	215.000	26.800
16	34.025	30.820	12.700	12.500	99.075	91.375	215.000	26.800
23	33.800	30.905	12.200	12.500	99.100	91.375	214.000	27.500
30	33.988	31.581	12.000	12.500	98.688	91.375	212.000	28.100

ENGINEERING AND MINING JOURNAL

FEBRUARY 1960

Will the Momentum of the 50's Carry Over into the 60's?

BECAUSE MINING FOLLOWS national industrial output so closely, we will find our first answer to the above question in the opinions business economists have expressed about the 60's. They tell us that we can look forward with confidence to continued growth and healthy expansion during the next decade—also that the ground rules of doing business are going to be decidedly different because of the impact of foreign competition and revolutionary changes in markets and technology which engineering and research will bring about.[1]

A review of the pattern and momentum of the 50's also portends what will happen in the 60's.

First we learned not to rely too heavily upon Government stockpiling, subsidies or other forms of support and protection because they are poor substitutes for industrial self discipline. As the decade closed, international nonferrous metal producers exhibited an encouraging willingness to launch a two-pronged attack on sagging markets and prices by: (1) Studying methods of voluntary production control to bring supply in reasonable balance with demand, and (2) financing bolder market research and development programs to stimulate the use of metals. This trend will increase during the 60's. Point 2 was demonstrated by the aluminum industry. Large companies which spent as much as five per cent of gross sales for market research and development contributed to the growing use of aluminum, which doubled twice in a decade.

The 50's saw the greatest prospecting boom in all mining history—the uranium rush which resulted in the growth of a $300-million-a-year domestic industry from infancy to maturity within the decade. What will happen to this industry in the late 60's is obscure. A break-through in nuclear technology, perhaps in the direct production of electricity from heat or nuclear emanation, might speed up commercial markets for uranium and clarify the future.

Will there be other boom metals in the '60's? Beryllium still has definite possibilities, and tellurium is looking mighty attractive. Here again, research will have to provide the answer.

New alloys consisting of unusual combinations of metals have been developed that show great commercial promise in the 60's. New York University announced one type containing vanadium, tin, titanium and copper; and Hydrometals Inc. announced another alloy containing principally copper and zinc with some titanium. The latter is said to be competitive with aluminum, stainless steel and galvanized iron. See Titanium review p 133.

Solid-state physics, the new science which evolved during the 50's, has given us the semi-conductor which outmoded many electronic tube applications, displaced the motor-generator set with the silicon rectifier, and threatens to revamp our whole system of heating and cooling, and possibly generating electricity. Related to this will be accentuated interest in high-purity semi-conductor metals such as arsenic, antimony, tellurium, bismuth, indium, selenium, germanium, and others. Purity will be expressed in terms of 99.999% material or better.

The late 50's also brought in the direct reduction of iron ore, which will permit small nations lacking in coking coal but rich in iron ores to establish small economic steel mills. The direct-reduction project now undertaken by Webb & Knapp Strategic Corp. to produce iron and steel products from copper smelter slag at Clarkdale, Ariz. will certainly be one development to watch. If the combined efforts of many large companies now working on direct-reduction processes materialize in feasible projects as expected, this development will be one of the most significant in the history of the iron and steel industry.

To combat inflationary labor costs during the 50's, management was forced to modernize on an unprecedented basis. Drill jumbos with mechanical or hydraulic controls were developed for raises, drifts, and shafts. Mines with unheard-of stripping ratios, as high as 30 to 1, were opened up because labor costs for surface mining are so much lower than underground mining. Large mining investment firms are diverting their attention from underground mining prospects to those which can be mined by open-pit methods. Johns-Manville, which converted its Jeffrey pit to caving operations, is swinging back to open-pit extraction, see Asbestos review, p 150. The challenge of the 60's will be the development of economic mass-mining methods and new labor-saving methods of materials transport for underground properties.

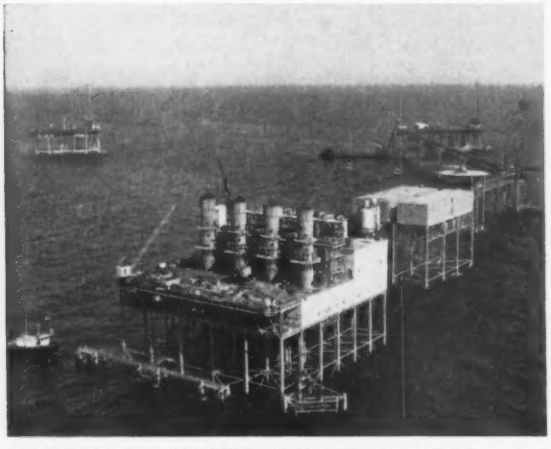
Perhaps the 60's will mark the mining of tremendous manganese resources from the sea bottom, or the extraction of unlimited metallic ions from the sea by processes related to flotation, ion exchange or solvent extraction. Certainly researchers are thinking about these things, and, in fact, working on them.

A panorama of significant projects of the 50's appears on the following pages. Will the 60's bring in more like them? If we continue to exploit 100-million tons of copper ore per year, and an equivalent amount of iron-bearing ores each year in the U.S. alone, exploration and development work will have to continue without interruption, and the plants to process the ores must follow. Following the Toquepala's and San Manuel's of the 50's we may certainly expect to hear more about new projects such as the $80-million Rio Blanco operation planned by Cerro de Pasco in Chile, and the Mission Project now being developed by Asarco in Arizona.

1"New Forces in American Business," by Dexter M. Keezer and Associates, McGraw-Hill Department of Economics.

WILL THE MOMENTUM OF THE 50'S .....

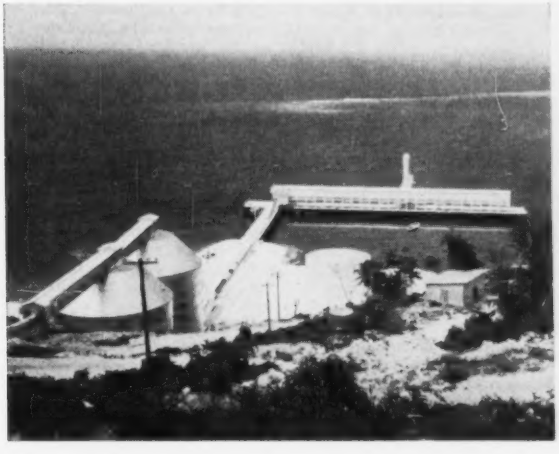
THE 50'S, AN ERA OF BIGNESS. Erie Mining Co.'s $300-million taconite project (left) went onstream with a production capacity of 7.5-million tons of pellets per year. Reserve Mining Co.'s $200-million operations (right), also producing pelletized concentrates from Minnesota's low-grade taconite ores, has a capacity of 3.75-million tons.



PROGRESS IN NONMETALLICS. Freeport Sulphur Co.'s $30-million sulphur project (left), 7 miles off the coast of Louisiana, is scheduled for production soon. Research stimulated new demands for borax. Result: U.S. Borax & Chemical Co.'s $20-million open-pit development and processing plant (right) which was dedicated at Boron, Calif., Nov. 1957.

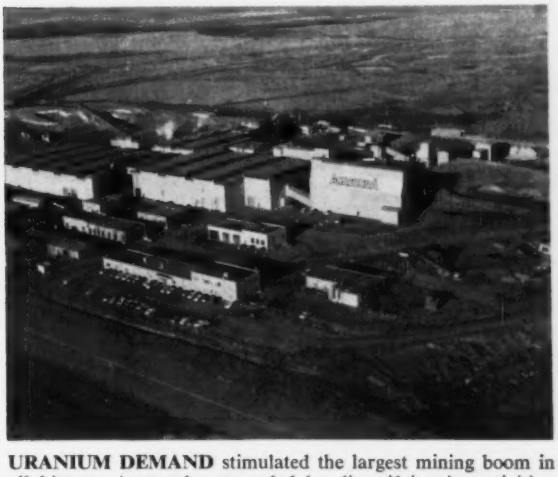
CANADIAN HIGH LIGHTS. Quebec Iron & Titanium Corp.'s new titanium smelter at Sorel, Quebec, (left) expanded output to 217,000 tons of titanium slag, and 151,000 tons of iron in 1959. Pit blast (right) at Iron Ore Co. of Canada's operations near Schefferville, in Quebec-Labrador area, symbolizes impact which Canadian production will have in 60's.

MANY ENGINEERING AND DESIGN FEATURES of San Manuel's modern plant (left) and others in the Southwest are incorporated in Southern Peru Copper Corp.'s plant now on-stream at Toquepala. Thus technology of the 50's carries over into the 60's, and the engineers of North American enterprises share technical knowledge with South American producers.



A GREAT WORLD SOURCE OF BAUXITE was developed in Jamaica during the 50's largely through efforts initiated by Reynolds Metals Co. Port at Ocho Rios is shown above.

ALUMINIUM LTD.'S $500-million Kitimat project, British Columbia, is one of the huge ventures of the decade. Jamaica-produced alumina is treated in the smelter shown above.



URANIUM DEMAND stimulated the largest mining boom in all history. Anaconda responded by diversifying its activities, and built this large uranium mill at Bluewater, N.M.

EXHAUSTION OF COPPER ORE RESERVES at Potrerillos, Chile, prompted Anaconda to develop the new underground mine at El Salvador and build the huge plant shown above.

Mine, Mill and Smelter Survey

WILL THE MOMENTUM of the '50's carry over into the 1960's? Sometimes a look back offers a look ahead. In 1959, 61 new projects were announced, 42 were still under construction from previous years, another 46 went into production and 34 others were in the throes of expansion programs—a solid year of sound achievement. Yet even this impressive record is overshadowed by the "Watch For" list of projects and areas— 90 in all—where exploration and planning are under way. For example:

Iron ore—there are 24 hot spots in the list. A big project in any one might cost more than all the U.S. uranium mills put together (see "Uranium", p. 108). There are plans under consideration in Argentina, Brazil and Canada—any one of which might develop into another Wabush Iron, Ungava Bay, Quebec Cartier.

Copper discoveries continue to be made—in Rhodesia, a long legendary "hill of copper." Bathurst, the Highland Valley, and Michigan's Upper Peninsula are focal points of exploration, Safford, Ariz. has been the seat of rich copper and silver strikes.

Aluminum, completing a 10-year period of fantastic growth, seems about to begin another—projects are on the drafting boards in Ghana, the Congo, in Australia, Peru, Venezuela. Large silver strikes have been made in Utah; gold in Africa. "Operation Grasshopper" governmental exploration programs are being conducted in Surinam, Turkey, Egypt, Maine, Morocco and Chile. This is the momentum of the '50's which will carry over to the 1960's.

Projects Announced or Starting Construction in 1959

MANGANESE

Colorado. A $6.7-million manganese refinery will be erected in either Durago or Grand Junction by an "eastern group" according to Standard Uranium officials. Standard will provide the rhodonite concentrate.

Newport News, Va. Union Carbide is building a 30,000-ton per month manganese ore dressing plant to treat British Guiana ore.

IRON ORE

Ulu Rompin, Malaya. Eastern Mining & Metal Co. plans to open a 2.5-million-tpy mine to replace worked-out Dungun. Cost—M $50-million. Reserves are 17-million tons, 62% Fe.

Kolari, Finland. Otanmaki Oy will develop large orebody.

Los Andrianitas, Chile. Mitsuibishi Mining paid $1.5-million for property with 10-million ton reserves, 65% Fe; will spend $1.5-million on 40-mile rail spur. Mine is operated by Yawata Iron & Steel Co. Cost to open the pit was under $300,000.

El Laco, Chile. Cia. Minera Santa Fe will mine a 3-billion tons, 66% Fe orebody. Cost will be high—about $250-million for 400-km railroad, seaport and town.

Algarrobro, Chile. Cia. Acero del Pacifico will seek finances for 100-million ton high-grade deposit.

Vancouver Island, British Columbia. Nimpkisk Mines Ltd. spent $2-million to open mine for fall shipments to Japan.

Kimberley, British Columbia. Consolidated Mining & Smelting has started construction of a steel producing center to use old mill tailings (15-million tons with newly mined 350,000 tons added each year). Cost will be $20-million, onstream in 1961 at 100,000-tpy output (36,500-tpy electric steel).

Carol Lake, Labrador. Iron Ore Co. of Canada will build a 6-million tpy pellet mine and mill at cost of $150-million. One orebody of several in area has 400-million tons, 35% Fe.

Williams-Port Arthur, Ont. Premium Iron Ore Co. plans a HyL Process steel center for Steep Rock ore at 150,000-tpy steel. Cost will be $10-million.

Varennes, Que. Quebec South Shore Steel Corp. plans a Udy Process steel center by 1961 at a cost of $22-million—two electric furnaces for 150,000-tpy of pig iron.

Clarkdale, Ariz. Zeckendorf Steel Co. will erect a $15-million Udy Process steel-copper-and-zinc and building-block center on the old United Verde Extension property. Copper smelter tailings will be used at 500-tpd. Due in 1961.

Los Angeles, Calif. Bethlehem Pacific Coast Steel Corp. is building a 110-tpd H-iron plant.

Lind-Greenway, Minn. J&L is stripping two pits for 700,000-tpy output and is erecting a washer.

Sherman, Minn. Oliver Mining Co. will erect a concentrator next to Sherman; due in 1961 at 1.5-million tpy concentrate.

Anaconda, Mont. Zeckendorf Steel will erect a Udy Process iron-steel-copper-zinc and building-block plant to use Anaconda tailings and hot slag (3,300-tpd).

COPPER

Alaska, Southern Rhodesia. Messina (Transvaal) Development Co. has formed Messina Rhodesia Smelting & Refining Co. to erect 2.1-million copper refinery and $1.4-million mine and mill.

Northern Rhodesia. Rhodesian Selection Trust will spend $185,000 to open a 2-million ton, 4.8% Cu orebody west of Chibuluma.

Finland. Outkumpu Oy will exploit an iron ore find with 50-million West German mark loan at 600,000-tpy ore to yield 5,000-tpy copper, 18,000-tpy zinc, and 160,000-tpy iron ore. Reserves are sufficient for 30 years.

Rio Blanco, Chile. Cerro de Pasco Corp. will mine and mill at 11,000 tpd a large orebody—112-million tons, 1.6% Cu. Mining will be by block-caving and the cost will be $70-million ($90-million with a smelter).

Disputada, Chile. Cia. Penarroya is building a new 3,000-tpd mill for the mine. Company is also rebuilding Chagres smelter.

Tocopilla, Chile. Cia Minera de Tocopilla is erecting a leaching plant at the 300-tpd flotation mill; will use 7-tpd acid.

Meme Valley, Haiti. Sedren S.A. is building a 1,500-tpd flotation mill for the mine—high-grade bornite and chalcopyrite. Due in 1960.

British Columbia, Canada. Granby Mining Co. Ltd. is re-opening the old Pheonix mine after 40-year shutdown. Mine and mill will handle 5,000 ton a week.

Chibougamau, Que. Copper Rand Chibougamau Mines planned to have a 1,500-tpd mill onstream by end of 1959.

Chibougamau, Que. Campbell Chibougamau Mines is adding two new producers—Henderson near Portage Island and Kokko Creek at Dore Lake.

Christmas, Ariz. Inspiration will invest $15-million to develop a mine and mill on the Christmas property of 20-million tons, 1.83% Cu. Due in 1961.

Tucson, Ariz. Amercan Smelting & Refining Co. has given Western-Knapp a contract for the mill at the Mission project. Mine and mill will handle 15,000 tpd and cost about $43.5-million.

BAUXITE-ALUMINA-ALUMINUM

India. Kaiser Aluminum & G. D. Birla will build a $30-million alumina-aluminum project. Due onstream in 1962.

French Guiana. Kaiser Aluminum and Bureau Miniere Guyanais have formed a consortium to produce bauxite from 70-million ton Kaw Mountain deposit.

Vera Cruz, Mexico. Alcoa plans a $20-million, 20,000-metric tpy refinery.

GOLD

Union of South Africa. Union Corp. has announced plans for two new mines—two companies formed to operate them; Bracken Mines and Leslie Mines (each will cost about $22-million).

Camp Bird, Colo. Camp Bird Ltd. is building a new mill at this famous old producer.

LEAD-ZINC-SILVER

Udiapur, India. Metal Corp. of India and Rio Tinto will build a $12.6-million zinc smelter.

Spain. Minera Celdran, S.A. will complete a 12,000-tpy electrolytic plant by the end of 1959 to treat Cartagena ores.

Spain. Sociedad Austuriana del Zinc will erect a 20,000-tpy electrolytic zinc refinery.

Mexico City, Mexico. Asarco and Productos de Cinc y Plumbo,

—a Look at Mining 1960

S.A. will erect a 200-ton per month zinc plant to cost $450,000.

Port Maitland, Ont. Sherbrooke Metallurgical Co. (Mathiessen & Hegeler Zinc Co.) will construct sinter, acid plant and smelter for zinc.

Mullan, Idaho. Lucky-Friday Silver-Lead Mines Co. started and completed construction of a 400-tpd mill at cost of $800,000 in 1959.

Lakeview, Ore. Federal Uranium has a silver mine in the Conjecture mine and will build a mill in 1960.

Ione, Wash. Utahcan Inc. started and completed a 150-tpd mill for the open-pit mine in 1959.

URANIUM

Canon City, Colo. Cotter Corp. has been operating 50-tpd pilot plant and has the AEC 200-tpd mill contract for Front Range ore.

Casper, Wyo. Globe Mining Co. got contract for 492-tpd mill to cost $3-million. Mill went into production in January 1960.

Riverton, Wyo. Federal-Radorock-Gas Hills Partners got contract for 522-tpd mill to cost $3-million. Mill went onstream in December 1959.

MISCELLANEOUS METALS

Carteret, N. J. American Metal Climax Inc. will erect a germanium refinery to treat material from Africa.

San Luis Potosi, Mexico. Noranda Mines of Canada is setting up a mercury operation.

Huitzuco, Mexico. Dowa Mining Co. is working up an old mercury property.

Oruro, Bolivia. Cia. Estanifera del Brazil has proposed a $3-million tin smelter for 1960 to dress 3,300 tpy of concentrate.

Bangka Island, Malaya. Bangka Mining Co. is planning a $3.5-million tin smelter to yield 25,000 tpy.

Ocean County, N. J. Glidden Co. has purchased inland beach sand deposit from American Metal Climax Inc. and will mine and mill.

NONMETALLIC MINERALS

Napa, Calif. Clute Corp. purchased Asbestos Bonding Corp.'s 1.8-million ton asbestos deposit and plans a 1,000-tpd mill.

Stockton, Calif. Jefferson Lake Sulphur Co. purchased American Asbestos Co.'s 15-million ton chrysolite deposit and will build a 2,000-tpd mill.

Dierks, Ark. U.S. Glass & Chemical Corp. will develop a 35,000-tpy barite mine and plant at cost of $500,000.

Bovill, Idaho. J. R. Simplot Co. will develop a $2-million clay and silica sand operation—100,000 tpy each. Due in January 1960 at 500 tpd.

Carlin, Nev. Hoops Construction Co. and Pumice Inc. plan a diatomaceous earth operation. Cost—$2-million.

Belingwe Native Reserve, Northern Rhodesia. Rio Tinto has purchased the huge emerald reserve for $2.1-million.

Livingston County, Ky. Atwood Mining Co. is building jigging plant for fluorspar.

Apex, Nev. Fibreboard Paper Products Corp. planned to open gypsum deposit by August 1959 with 750-million ton reserves and ship to California processing center at 45,000 tpy. Cost, $1-million.

Rosaria, N.M. Kaiser Gypsum Co. will build a processing plant to use local gypsum.

Tampico, Mexico. U.S. Gypsum Co. plans to spend $5-million on mine with 2-billion ton reserves and ship at 1,500 tpd.

Pemberton, B.C. A 20-million cu yd deposit of pumice will be mined by John McIsaac. Cost about $600,000.

These Projects Are Still Under Construction

MANGANESE

Gabon, Africa. World Bank loan of $35-million has been made to Comilog. First ore is due out in 1962 at 500,000 tpy. Transportation is a major cost item—cableway and 180-mile railroad. Total cost is expected to be $89-million. Project involves U.S. Steel and French interests.

British Guiana. African Manganese Co. plans to have a property in production in 1960. Railroad alone cost $7-million (1957).

IRON ORE

French Equatorial Africa. Societe des Mines de Fer de Mekambo will spend $350-million (1959) to open high-grade deposit which includes 460-mile railroad. Bethlehem Steel owns 50%. Due to produce in late 1964. Rate in 1967 is to be 10-million tpy.

Sibuguey, Philippines. Samar Mining Co. is pushing construction of mine on high-grade 7-million ton orebody. Spent $500,000 on road to mne.

Minas Gerais, Brazil. Brazilian-Japanese group, National Steel Co. and Vale do Rio Doce Iron Co. are completing a 500,000-tpy mine and concentrator with estimated cost at $57-million (1958).

Monterrey, Mexico. Hojalata y Lamina, parent company of Fierro Esponja, is completing construction of a 500-tpd HyL Process sponge iron plant.

Nahuatl, Colima, Mexico. Estimated $3.8-million ton magnetite deposit will be worked at a cost of about $4.8-million (1958).

Steep Rock, Ont. Caland Ore Co. will be onstream in 1960 at initial rate of 750,000 tpy; will reach 3-million by 1969.

Lac Jeannine, Que. Quebec Cartier (U.S. Steel) is developing mine and pelletizer for production by the end of 1960. Eventual capacity of 8-million tpy, 66% Fe pellets is planned. Cost (including 163-mile railroad) is $300-million.

Ungava Bay, Que. Cyrus Eaton and Fried Krupp will share cost of constructing a mine, mill and harbor (and ore boats) for Ungava Iron Ores Ltd. Eventually capacity is to be 5-million tpy. Cost estimate is in excess of $200-million.

Wabush Lake, Labrador. Wabush Iron Co. Ltd.—Inland Steel, Pickands Mather and others—is developing mine and concentrator for 4- to 5-million tpy output (pellets) by 1965. Due onstream in 1961. Total cost about $200-million.

Pea Ridge, Mo. Bethlehem Steel and St. Joseph Lead Co. plan to have mine and mill onstream by end of 1962—cost about $40-million.

Conshohocken, Pa. Alan Wood Steel was to start operating a 50-tpd H-Iron Process plant in 1959—cost, $3.6-million.

COPPER

French West Sahara. Societe des Mines de Cuivre le Mauretanie (Micuma) has completed pilot plant work (1958) on two deposits —30-million tons, 1.5% Cu and 30% Fe with oxide cap running 2.5% Cu; and 15-million tons, 52% Fe. A 124-mile railroad must be built.

Cerro Blanco, Chile. Callejas Bros. are building a flotation mill at Quebradita, Atacama province.

Mantos Blancos, Chile. Mantos Blancos is due in 1960. Cost is about $18-million for mine, acid-leach plant and fire refinery. Mauricio Hochschild interests have 10.5-million ton reserve. Will leach about 2,000 tpd for 12,500-tpy cement.

Vicosa, Brazil. Cia. Brasileira de Cobre is constructing a 3,000-tpy copper project.

Antofagasta, Chile. Nippon Mining Co. and Daiichi Bussan Kaisha are developing Portequela open pit to produce 100 tons per month contained metal to be refined in Japan.

Toquepala, Peru. Southern Peru Copper Corp. is almost onstream. Total cost will be in excess of $230-million for 120,000-tpy metal.

Flin Flon, Manitoba. Hudson Bay Mining & Smelting is completing the development of Stall and Chisel Lakes mines.

BAUXITE-ALUMINA-ALUMINUM

French Guinea. Fria—Olin Mathieson, Pechiney, Ugine, British Aluminium and Aluminium Industries, AG, plan to have $135-million operation onstream in 1962. Reserves are 1.5-billion tons of bauxite. Cost is for 480,000-tpy alumina and 150,000-tpy aluminum.

Borneo. Aluminium Ltd. is developing a 175,000-tpy bauxite mine.

Uttar Pradesh, India. Aluminum reduction works being built near Pipri (Rihand Dam will have 20,000-tpy capacity when onstream after 1961. Indian government, Birla Bros. and Pechiney involved 1958).

Lacq, France. Ugine is building a second electrolytic aluminum plant of 23,000-tpy capacity and Pechiney is building a 50,000-tpy facility (1958).

Surinam. Alcoa is spending $45-million on a 150,000-kw hydroelectric project and planning a 60,000-tpy reduction works to cost $150-million (1958). Due in 1965.

Brazil. Brasileira de Alumino was to have 10,000-tpy reduction works onstream by the end of 1959.

Warrick, Ind. Alcoa has renewed construction on its $80-million 150,000-tpy reduction works.

GOLD

Union of South Africa. Free State Saaiplaas Gold Mining Co. Ltd. is nearing production—due in July 1960 at 50,000 tons per month.
Union of South Africa. Western Deep Levels Ltd. will start milling ore by late 1962.
Union of South Africa. Rand Mines and Western Areas will go ahead with a mine—two shafts are going down.

LEAD-ZINC-SILVER

Australia. Sulphide Corp. Pty. Ltd. is building one sinter plant and one zinc blast furnace by 1961 at 38,000 tpy zinc and 40,000 tpy lead. Cost will be about $28-million.
Noyelles Godault, France. Penarroya is erecting a large zinc blast furnace (1958).
Nova Iquacu, Brazil. Zinc plant with 7,200 tpy output was due by the end of 1959.
Kellogg, Idaho. Bunker Hill Co. has decided to put the fertilizer plant at Kellogg and has started construction (1959) for 200,000-tpy capacity. Cost $10-million.

MISCELLANEOUS METALS

Australia. Westralian Oil Ltd. has an ilmenite and rutile concentrator under way for capacity of 100,000 tpy of beach sand.
Thompson, Manitoba. International Nickel Co.'s project is to be onstream by 1961 with planned capacity of 75-million lb of nickel a year from Moak-Mystery Lakes mines, mills and the smelter. Total cost will be over $175-million.
Selma, Ala. Alabama Metallurgical Corp. (part Calumet & Hecla) is building a 6,000-tpy magnesium refinery using the Pidgeon Process (ferrosilicon reduction). Cost is about $3.5-million.

NONMETALLIC MINERALS

Tehuantepec, Mexico. Central Minera, S. A. is completing a 1,000-tpd Frasch sulphur mine (1958).
Esterhazy, Sask. Continental Potash Co. is sinking a 3,300-ft shaft, plans 112,000 tpy of potash.
Esterhazy, Sask. International Minerals & Chemicals planned to have a $20-million mine and potash refinery onstream by the end of 1959 to yield 720,000 tpy potash.
Okotoka, Sask. Texas Gulf Sulphur planned to complete a $6-million 370-tpd sulphur-from-sour-gas-plant in 1959.
Grande Isle, La. Freeport Sulphur Co.'s Frasch sulphur mine seven mines offsore is due in 1960 at a cost of $30-million.
Carlsbad, N.M. Farm Chemical Resources Development is developing a mine and potash refinery (1958).
Allamoore, Texas. Pioneer Talc Co. mill was due to be completed by the end of 1959.
Vernal, Utah. Stauffer Chemical is completing a mine and mill and phosphorus furnace at a cost of $20-million.

Projects Onstream in 1959

MANGANESE

Natal, South Africa. Ferroalloy's manganese reduction works is onstream at cost of $33.6-million. Production is 120-tpd ferro-manganese from 300-tpd ore.

IRON ORE

Acari, Peru. Pan American Commodities, S. A. has Acari onstream. Planned capacity is 5,000 tpd, 65% Fe magnetite. Mine is lump ore for open hearth use and is found near Marcona. Pan American got $8.5-million loan.
El Trueno, Venezuela. Mivenca started construction in 1957 and was due onstream in 1959 at $52-million. Production, 3.5-million in 1960; 7-million in 1962.
Jamestown, Ont. Algoma Ore Properties was to have Sir James mine in production in 1959 (siderite).
Moose Mountain, Ont. M. A. Hanna mill has been onstream since Spring with capacity of 500,000 tpy pellets.
Groveland, Mich. M. A. Hanna Co. has put a 700,000-tpy pelletizer onstream at cost of $11-million.

COPPER

Northern Rhodesia. Bancroft is back in production after being dewatered (October). Mine has capacity of 150,000 tons per month.
Timna, Israel. King Solomon's mine in operation at 9,000-tpy cement copper. Reserves are insufficient for 15 years. Cost was $10-million.
Bagacay, Philippines. Marinduque Iron Mines Agents, Inc. has put a $2.5-million copper-zinc mine and mill into production at 600 tpd. Reserves are 3-million tons.
Townsville, Australia. Mt. Isa refinery is producing. Cost was $7.9-million. Eventual capacity will be 100,000 tpy.
El Salvador, Chile. Anaconda Co.'s mine and mill cost $103-million for 100,000-tpy copper output. Reserves are 375-million tons, 1.5% Cu. Larger smelter will be needed. Ore feed is 24,000 tpd.
British Columbia. Consolidated Woodgreen Mines has 1,000-tpd mill.
Ontario. Coldstream Copper Mines—Noranda—has been re-opened.
Temagami, Ont. Temagami Mining Co. has 200-tpd mill. Reserves 100,000 tons, 13% Cu.
Hayden, Ariz. Kennecott out the $40-million project onstream—new smelter, LPF plant and Ray mine expansion included.
Tucson, Ariz. Duval Sulphur & Potash Co. opened the $20-million mine and Esperanza mill. 10,000 tpd. Reserves are 49-million tons, 0.75% Cu.
Baltimore, Md. Kennecott Refining Co. completed before the end of 1959. Cost was $30-million for 16,500 tons per month output. To hit full capacity by mid-1960.

BAUXITE-ALUMINA-ALUMINUM

Orissa, India. Indian Aluminum Co. completed 11,200-tpy reduction works at cost of $10-million as part of a $30-million bauxite-alumina-aluminum expansion program.
British Guiana. Aluminium Ltd. was to have 250,000-tpy, $33-million alumina plant onstream in 1959.
Cabo Rojo, Dominican Republic. Alcoa's bauxite mine went into production in 1959. Cost—$14-million.
Alton, Ill. Asarco put the 72-million lb secondary smelter of Federated Metals onstream.
Massena, New York. Reynolds Metals Co. put 100,000-tpy aluminum reduction works onstream in 1959 at a cost of $88-million.
Point Comfort, Texas. Alcoa was to complete the alumina plant in 1959 at a cost of $45-million. Plant has 1-million-tpy output.

GOLD

Kaka River, Bolivia. South American Placers is in production from one dredge on "bonanza rich" Kaka River. Cost was $3-million.
Pachuca, Mexico. Real del Monte y Pachuca has a 7,500-tpd flotation mill onstream treating old cyanide-mill tailings. Cost was $1-million.
Round Mountain, Nev. Round Mountain Gold Dredging Co. is onstream with 10,000-cu yd per day dredging rate.

URANIUM

Australia. United Uranium mill went into production in March 1959.
Rockhole, Australia. South Alligator Uranium's solvent extraction plant went onstream in the fall of 1959.
Bombay, India. Indian Rare Earths (Pvt) Ltd. opened the government's $462,000 metal refinery in January 1959.

MISCELLANEOUS METALS

Rustenburg, South Africa. Rustenburg Chrome Mines (Pty) Ltd. has opened chrome mine to sell to Bayer (Germany). Cost was $700,000.
Moa Bay, Cuba. Moa Bay Mining Co. completed a mine and concentrator and Freeport Nickel Co. completed a nickel refinery at Port Nickel, La. to yield 25,000-tpy nickel, 2,200-tpy cobalt and 92,000-tpy ammonium sulphate fertilizer. Cost was $119-million total.
Elliot Lake, Ont. Rio Tinto Dow Ltd. opened a $1-million thorium-from-uranium-mill section at the Algom property (100-to 200-tpy concentrate).
Malaya. Malayan Tin Dredging Co. put another dredge in the water at Tanjong Tualang. Cost was M $8-million for 400,000-cu yd per month capacity.
Finland. Outokumpu Oy's Katalahti mine was due to ship nickel ore in 1959 to the Harjavalta smelter (1958).
Kangwon Province, Korea. Korea Tungsten Mining Co. now is able to treat the fines. A chemical section was added to yield 65% WO_3 concentrate.

NONMETALLIC MINERALS

Rosalind, Alberta. Magcobar Drilling Mud Co. has erected a $400,000 bentonite mud processing plant to produce 25,000 tpy.
Mexico. La Domincia, S. A. (Dow Chemical Co.) has fluorspar flotation mill onstream making acid-grade spar.
Tawas City, Mich. National Gypsum Co. opened mine here and processing plant at Waukegan, Ill., and is building another processing plant at Lorain, O. Total was to be about $25-million.
Sperry, Iowa. U.S. Gypsum's mine is shipping to processing plant.
Taos County, N.M. United Western Minerals' United Perlite Corp. perlite popper onstream. Reserves are sufficient for 20 years. 250-tpd production on one shift.
Minitatlan, Mexico. Texas International Sulphur Co. is in production at 9,000 tons per month.

Salta Province, Argentina. The government has sulphur extractor on-stream at 20,000-tpy sulphur from volcanic reserves. Cost was $1-million.

Expansion Programs Going On Here

MANGANESE

Knoxville, Ky. Foote Mineral Co. will expand electrolytic manganese production with a $200,000 investment.

IRON ORE

Brazil. Cia Vale do Rio Doce will raise iron mine output to 6-million tpy. Loan for railroad, port and mine expansion of $12.5-million made.

Cooper Cliffs, Ont. International Nickel Co.'s $20-million iron-form-pyrrhotite tailings plant due to be completed in 1959—capacity, more than 200,000 tons, 68% Fe pellets.

Hull, Que. Hilton Mines is expanding pellet capacity from 600,000 to 800,000 tpy. Due in 1960.

Sorel, Que. Quebec Iron & Titanium started an expansion program in 1957 and completed it in 1959 at a cost of $16-million. Eight electric furnaces have 350,000-tpy titanium-bearing slag.

Eagle Mountain, Calif. Kaiser Steel Corp. has expanded the pit to take care of Fontana's expanded capacity of 2.9-million tpy of steel. Since 1957, Kaiser has spent $194-million on Fontana and Eagle Mountain expansion.

Hill-Annex, Mich. Jones & Laughlin Steel Corp. will double capacity and modernize the washer with a spiral and heavy-media plant.

Humboldt, Mich. Humboldt Mining Co. (Ford Motor Co. and Cleveland Cliffs) is expanding to 2,000 tpd (600,000 tpy pellets); eventually will have 2-million tpy capacity.

COPPER

Northern Rhodesia. In 1957, Mufulira began an expansion program (to be completed in 1962) to reach 150,000-tpy copper output. Cost $39.6-million.

Paipote, Chile. Paipote smelter has expanded from 10,000 to 22,000 tpy output.

Queensland, Australia. Mt. Isa Mines is expanding the smelter at a cost of $8.2-million, starting at the end of 1959 to expand from 40,000- to 60,000-tpy refined copper output. Mt. Isa has spent $50-million over the past three years to raise mine output from 6,000 to 8,000 tpd.

Bisbee, Ariz. Phelps Dodge will invest $5-million in the Lavender pit.

Nevada. Kennecott installed a $1-million inclined skip hoisting system to get ore out of the Liberty pit.

West Jefferson, N. C. Appalachian Sulphides, Inc. to expand mill from 400 to 800 tpd.

Bingham Canyon, Utah. Kennecott has completed an 18,000-ft tunnel into the pit to ease ore haulage. Drive started in 1956 and cost about $11-million to complete.

Garfield, Utah. Western-Knapp has contract to modernize Garfield smelter for Kennecott. Cost—$10-million.

BAUXITE-ALUMINA-ALUMINUM

Ewarton, Jamaica. Alumina Jamaica's second alumina plant started operating late in 1959. Plant has 250,000-tpy output capacity.

Corpus Christi, Texas. Reynolds Metals expanded docking facilities at a cost of $1-million.

LEAD-ZINC-SILVER

Mascot, Tenn. American Zinc will expand mill by 400,000 tpy within three or four years for an eventual capactiy of 1.6-million-tpy ore feed and 100,000-tpy concentrate. Coy mine went into production, January 1959. Young mine is due to reach 1-million tpy by 1961.

GOLD

Union of South Africa. West Driefontein will expand milling rate to 205,000 tpm at a cost of about $25-million over next five years.

Yukon Territories. Giant Yellowknife Gold Mines is installing equipment to raise capacity to 1,000 tpd from present 760.

Kirkland Lake, Ont. Upper Canada Mines will expand mill capacity to 1,000 tpd from present 600.

Malartic, Que. Barnat Mines is expanding mine capacity to 2,000 tpd from present 600; to reach 1,600 tpd in late 1959; 2,000 in 1960. Barnat's mill capacity will be 700; rest of ore will be milled at Malartic Gold Fields.

Clinton, Mont. Clinton Mining & Milling Co.'s 50-tpd mill is being expanded to 200.

URANIUM

Moab, Utah. Uranium Reduction Co. converted 880 tpd of its capacity to alkaline R-I-P at cost of $3-million.

Rawlins, Wyo. Western Nuclear Corp. got mill expansion contract to 850 tpd. Cost will be $1-million.

Riverton, Wyo. Lucky McUranium Corp. got mill expansion to 980 tpd with no cost involved.

Riverton, Wyo. Susquehanna Corp.'s 100-tpd acid plant onstream at cost of $750,000.

MISCELLANEOUS METALS

Bishop, Calif. Union Carbide has added an ammonium paratungstate circuit to the mill.

Salt Lake City, Utah. Minerals Engineering has purchased 50% interest in Salt Lake Tungsten Co. and has added an ammonium paratungstate section.

Lynn Lake, Manitoba. Sherritt Gordon Mines Ltd. has expanded nickel ore mining from 2,500 to 3,500 tpd. Reserves are 14.6-million tons., 0.9% Ni.

NONMETALLIC MINERALS

Kenya, Africa. Shah Vershi Devshi & Co. is expanding mine and mill to 2,500-tpy graphite.

Chile. Anglo-Lautaro Nitrate Co. will spend another $10-million on Maria Elena and Pedro de Valdivia nitrate evaporators.

Carlsbad, N.M. International Minerals & Chemical Corp. will spend $1-million to modernize the property.

Watch for Major Developments Here

MANGANESE

India. Planning for the ferromanganese industry has 1961 capacity at 172,000 long tpy with 100,000 for export. Five plants have been completed, two are in construction.

Perene, Peru. First token shipment of manganese ore (57% Mn) was shipped to W. R. Grace by Cia. Manganeso Perene.

IRON ORE

Northern Rhodesia. Swedish steel maker is interested in deposit near Lusaka; 66% Fe.

Liberia. Mount Nimba deposit may soon be developed—Liberian-American-Swedish Mineral Co. and Bethlehem Steel are negotiating.

Bomvu Ridge, Swaziland. Large hematite deposit discovered. Anglo-American is drilling—31-million tons to 500 ft depth. Will need large transportation investment.

Tasmania. Some 200-million tons of high-grade uncovered in the northwest by Rio Tinto on Savage River.

Argentina. Many proposals have been tendered to develop Sierra Grande's 100-million ton orebody—U.S. Steel ($150-million), Kaiser ($50-million) and Fried Krupp are among the bidders.

Brazil. M. A. Hanna is exploring around St. John d'el Rey. Government plans to have iron ore exports at 20 to 30-million tpy after 1961-2.

Chile. Japanese group has offered to spend $15-million of $30-million needed for blast furnace in Coquimbo.

Venezuela. M. A. Hanna Mining Co. and Republic Steel Corp. are drilling and tunnelling at jointly-owned Maria Lucia Ore Co. concession in Bolivar state. Hanna also has concession in Western Ore Co. near El Pao (20,995 acres).

Surinam. The government has invited Fried Krupp to open large deposit.

Ecuador. Koppers Co., Strategic-Udy and Universal Mineral Resources Inc. may build a Udy Process steel center.

Trinidad. Caribean Iron Mines Ltd. may mine a 20-million ton orebody.

Nakima, Ont. Anaconda Iron Ore (Canada) Co. has two orebodies, two miles apart, each holding some 200-million tons. A 2- to 5-million tpy pellet producer may be in the works.

Boston Twp., Ont. Jalore Mining Co. (J&L Steel Corp.) is examining orebody.

Newboro, Ont. New Mylamaque Explorations says that a 100,000 to 200,000-tpy pig iron Udy Process plant will be considered.

Temagami, Ont. North American Rare Metals is developing a 400-million ton, 31% Fe orebody; may build a 1.4-million tpy output pelletizer with 1963 target date.

Lyonne Twp., Que. Oglebay, Norton & Co. has option on 100-million ton indicated low-grade orebody.

Mt. Wright, Que. Normanville Mining Co. (J&L and Cleveland Cliffs) has 335-million ton. Process may be dry electrostatic-magnetic.

Carol Lake, Labrador. In addition to the Carol Lake project to be run by IOCO, Labrador Mining & Exploration Co. may put another concentrator in on a neighboring orebody.

Edgewood Lake, Alabama. Woodward Iron Co. has rights to 100-million ton deposit.

Minnesota. Governor Freeman has signed a semi-taconite bill which

gives similar tax advantages as the taconite laws. Also, Tax Commission is watching Newfoundland-Labrador-Quebec developments with alarm. Great Northern Railway and University of North Dakota have research under way to combine the development of lignite with the development of non-magnetic taconites.

Dillon, Mont. North American Utilities Corp. has purchased 60-million ton orebody from Minerals Engineering and plans a steel mill in Alberta.

Pershing County, Nev. Southern Pacific Land Co. has at least 60-million ton deposit; plans mine, mill and rail spur.

Star Lake, New York. W. S. Moore is still drilling McGraw-Hill property; visualizes 300,000-tpy output pelletizer.

Atlantic City, Wyo. Engineering drawings of the Columbia-Geneva pelletizer have been completed. Projected cost is $16-million.

COPPER

Southern Rhodesia. Rand Mines has committed $364,000 to prospect a 500-sq mi reserve in the north of Karoi where 2.5% Cu has been found.

Southern Rhodesia. A "hill of copper," long a legend in the Chirundu region may have been discovered. J. A. Bester sold a discovery to Anglo American for $1.4-million.

Barquito, Chile. Andes Copper Co. may start a new smelter in 1960 to handle the concentrate from El Salvador.

Cerro Landa, Chile. A mine may be in the works.

Santiago, Chile. National Smelters Corp. is to bid on a $40-million smelter and refinery now that Valparaiso (Ventanas) has given up the idea.

Highland Valley, B.C. Newmont Mining has taken option on Trojan Cons. Mines; Kenneco Explorations (Kennecott) has options and is drilling; Bethlehem Copper is seeking a $15-million loan to complete mine, build 7,500 tpd mill and is talking about a smelter with Craigmont.

Porcupine, Ont. MacIntyre Porcupine may have a copper mine in the Porcupine.

Algoma Mills, Ont. Pronto Uranium Mines Ltd. may mine and mill the Pater Uranium copper orebody when uranium contract runs out in 1962—reserves are 1-million tons, 2% Cu.

Safford, Ariz. Bear Creek has been buying acreage; American Metal Climax has also, and Phelps Dodge has reportedly uncovered a large silver-bearing vein in the area near the Morenci pit.

Pima, Ariz. Banner Mining Co. is exploring one 4% Cu orebody in the Pima district and is reportedly talking to both Pima Mining Co. and Asarco about the property.

Michigan. Mining may be revitalized in the Upper Peninsula after 1960 when the gas pipeline is installed. Also, American Metal Climax has discovered over 100-million tons, 1.25% Cu.

Montana. Bear Creek has taken claims southwest of Philipsburg.

Boss-Bixby, Mo. Granite City Steel and American Zinc have struck copper ore while looking for iron ore.

Glacier Peak, Wash. Bear Creek did four months of exploration on copper property.

Wisconsin. Cerro de Pasco and Bear Creek have filed leases on copper showings.

BAUXITE-ALUMINA-ALUMINUM

Ghana. Kaiser Engineers and consortium have been asked by the government to submit a proposal for a hydroelectric and aluminum reduction project. Dam alone will cost more than $156-million for Volta River.

Belgian Congo. Syndicate Aluminga is studying bauxite deposits. Still in planning stage for the Congo is a 7-billion kw hydroelectric plant and a 250,000-tpy aluminum reduction works. Due after 1964.

Welpa, Australia. Commonwealth Aluminium has projected costs of opening the 1-billion ton bauxite deposit at anywhere from $100- to $450-million depending on size of the reduction works chosen.

South Gippland, Australia. Reynolds Pacific Mines (Pty) Ltd. has indications of good-quality bauxite.

Jamaica. Alcoa has option on Mocho area acreage.

Panama. Alcoa Minerals, Inc. and Kaiser Exploration Co. have concessions for bauxite.

Paracas, Peru. Cerro de Pasco Corp. plans an aluminum reduction works and power project on the Mantaro River (1958).

Caroni Falls, Venezuela. Venezuelan Development Corp. projects an aluminum smelter of 25,000-tpy capacity (eventually 50,000) at a cost of $30-million (1958).

Lake DeSmet, Wyo. Reynolds Metals Co. owns large coal reserves, has spent $50,000 on a reduction works and site planning.

GOLD

Union of South Africa. Freddies may sink a deep mine with Western Holdings and another with Rand Mines in the western Transvaal. New Consolidated Gold Fields has mineral rights to 60,000 morgen (126,000 acres) north of the Mooi River. Republic Gold Mining Co. may have opened a new mining region at Humansdorp.

Bolivia. Natomas is drilling "bonanza rich" placers in Beni state, having the ground on both ends of the Kaka River property of South American Placers (see onstream under gold).

Beauceville, Que. Large placer shaping up; may lead to a dredge or two.

LEAD-ZINC-SILVER

Huehuetenango, Guatemala. Bunker Hill Co., with Camagra, is exploring Torlon, a 300-year old silver-lead-zinc producer. May be a large mine in the offing.

Bathurst, New Brunswick. Many companies back at work again on their properties as the zinc market perks up.

Mattagami, Que. Mattagami Lake Mines has been formed to take over Mattagami Syndicate's deposit—19.7-million tons, 12.7% Zn.

Mattagami, Que. New Hoscoe is considering an 800-tpd mine and mill.

Enterprise, Utah. Cerro de Pasco, Chief Consolidated Mining Co. and Armet may have high-grade silver producer in old Holt mine of Latter Day Saints.

East Tintic, Utah. Bear Creek and Chief Consolidated Mining Co. have what has been called the "first major silver discovery in the past 25 years."

MISCELLANEOUS METALS

Barreiro, Brazil. Huge pyrochlore deposits estimated to contain 186-million ton of pyrochlore at 5% grade.

Bindura, Southern Rhodesia. Japanese firm will erect a $2.8-million nickel refinery.

Dutch New Guinea. Dutch mining houses and U.S. Steel Corp. to open laterites (1.6% Ni) (200-million tons, 1.6% Ni in two separate deposits). Smelter is planned.

Sardinia. Highway construction uncovered a 5-million ton, 0.5% Mo orebody. Will be mined by Mazzacurati & Giancomelli.

Passos, Brazil. Morro de do Niquel will mine and produce 2,400-tpy ferronickel.

Cibao, Dominican Republic. Minera y Beneficiadora Falconbridge Dominicana is to pilot ore from a nickel orebody.

Powderhorn, Colo. E. I. du Pont de Nemours & Co. has taken large columbite claims—15- to 20-million tons of ore reported in the Powderhorn area.

NONMETALLIC MINERALS

Baie Verte, Newfoundland. Advocate Mines has pilot plant in the field, plans a 3,000-tpd mine and mill (cost, $20-million) in 1962.

Beauceville, Que. Golden Age Mines has pilot plant operating on asbestos property.

Wyoming. Vipont Mining Co. is considering a $10-million mine and processing center for large gypsum deposit.

Balsas, Peru. Rich nitrate strike named El Chato has been made.

Beaufort, S. C. Phosphate may be recovered from tide-water areas by Beaufort Mining & Development Co.

Vernal, Utah. San Francisco Chemicals has agreed to purchase 700-million ton low-grade phosphate deposit.

San Juan County, Utah. Superior Oil Co. has large potash deposit.

Cane Creek, Utah. Delhi-Taylor has large potash reserves and is reportedly in a deal with Armour & Co. Delhi has projected a $20-million, 1,500-tpd mine and mill.

Vancouver Island, B.C. Holdfast Natural Resources Ltd. may mine and mill 100 tpd of pozzalana from 100-million ton deposit.

Mojave Desert, Calif. Sunray Mid-Continent Oil Co. is doing extensive prospecting for saline materials.

GENERAL

Bechuanaland, Africa. Rhodesian Selection Trust has exclusive prospecting rights over a 40,000 sq mi untapped area.

Morocco, Africa. Fairchild Aerial Surveys, Inc. is doing work for the government.

Turkey. Aero Service affiliate may be granted large exploration and mapping contract.

Chile. A United Nations geological staff has been investigating and mapping the northern provinces at the request of the government.

Surinam. Operation Grasshopper conducted by Aero Service is to fly 80% of the country.

Pine Point, NWT, Canada. The railroad (cost—$70-million) and the highway (cost—$100-million) have been started. Cominco has large deposit of lead-zinc in the area and has agreed to build a large operation.

Saskatchewan. W. S. Kennedy Grubstake 1958 have option on 6,000 sq mi bloc of land in the William River area and are spending $400,000 in the search for minerals.

Crow Reservation, Montana. Indian law has been changed to permit leases for 10 years with a renewal option as long as the property continues to produce.

Maine. U.S. Geological Survey, Maine Geological Survey and many U.S. mining firms are conducting intensive exploration programs.

San Carlos Reservation, Ariz. Hunting, the mapping and survey firm, has exclusive right to map 1.6-million acre reservation and to lease up to half the land.

Major Metals

Francis H. Wemple
Treasurer, Handy & Harman

Silver demand increased substantially in 1959. Strikes, however, checked production and caused firm price conditions to prevail for most of the year. p 104

Dr. J. D. Hanawalt
Vice President
Dow Chemical Co.

Magnesium die casting was the principal area of development during last year, and promised a breakthrough into usage. p 103

Robert L. Ziegfeld
Secretary
Lead Industries Association

Lead's position improved in 1959, with increased consumption, reduced imports to the U.S. and agreement on voluntary controls throughout the world. p 101

Irving Lipkowitz
Reynolds Metals Co.

Aluminum production hit another all-time high with a primary output of 1,945,000 tons. Foreign trade saw primary and scrap exports from the U.S. rise at the same time that semi-fabricated imports increased. p 106

George H. Cleaver
Market Editor
Engineering & Mining Journal

Copper production and consumption in 1960 are likely to be higher than in 1959 and may be at a record level. Incomes of copper firms will probably be up. p 120

Charles R. Ince
Vice President
St. Joseph Lead Co.

Zinc improved its position in 1959 in spite of the steel strike. Increased consumption in other industries and import restrictions contributed. p 114

Alvin W. Knoerr
Editor
Enginering & Mining Journal

Steel competition from foreign producers and dwindling exports are forcing the domestic iron ore and steel industry to strive for lower costs, improved technology and higher productivity. p 118

James W. Franklin
Associate Editor
Engineering & Mining Journal

The coming year will be a good one for the U.S., the Congo and most of the uranium producers in the Union of South Africa and Australia, but Canada faces a difficult time in its stretch-outs. p 108

J. R. O'Connell, Jr.
Associate Editor—Markets
Engineering & Mining Journal

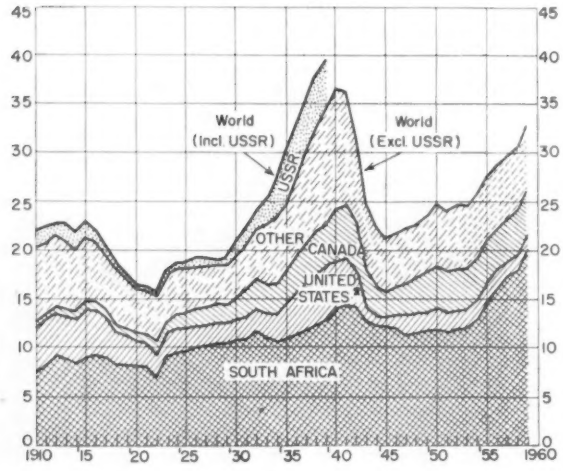
Tin in 1960 can expect a steady, balanced market, prices around 99¢, cancellation of export quotas, renewal of the ITA and possibly some U.S. stockpile sale. p 116

Dr. M. A. Kriz
The First National City Bank of N.Y.

Gold production rose 2.2-million oz with South Africa contributing some 20.1-million, and cutting its mining costs 3%. Total gold supply exceeded any other postwar year. p 98

World Gold Production

(Millions of fine oz)



Note: all 1957 data are provisional.
*Including Philippines through 1939.

	1959*	1958	1957	1956	1945	1940
North America:						
Canada	4.4	4.5	4.4	4.4	2.7	5.3
United States	1.6	1.8	1.8	1.9	0.9	4.9
Latin America:						
Mexico	0.3	0.3	0.4	0.4	0.5	0.9
Colombia	0.4	0.4	0.3	0.4	0.5	0.6
Chile	0.1	0.1	0.1	0.1	0.2	0.3
Nicaragua	0.2	0.2	0.2	0.2	0.2	0.2
Africa:						
Union of South Africa	20.1	17.7	17.0	15.9	12.2	14.0
Ghana	0.9	0.8	0.8	0.6	0.5	0.9
Southern Rhodesia	0.6	0.6	0.5	0.5	0.6	0.8
Belgian Congo	0.3	0.4	0.4	0.4	0.3	0.6
Asia:						
India	0.2	0.2	0.2	0.2	0.2	0.3
Philippines	0.4	0.4	0.4	0.4	—	1.1
Australia	1.1	1.1	1.1	1.0	0.7	1.6
Total	30.6	28.4	27.6	26.3	19.5	31.6
Other, excluding USSR	2.0	2.0	2.0	2.1	1.6	5.1
World, excluding USSR	32.6	30.4	29.6	28.4	21.1	36.7

* Tentative figures based on preliminary data.
Note: Figures may not add up to totals because of rounding.

Gold

Dr. M. A. Kriz
The First National City Bank of N. Y.

WORLD gold production rose in 1959—for the sixth consecutive year. At some 32.6-million fine oz (excluding output in the USSR), it was about 2.2-million oz more than in 1958, on the basis of preliminary or incomplete data available at the year-end. Last year's increase in world gold output was by far the largest in recent years—1-million oz above the annual average increase during the 1954-58 period. Gold production in 1959 was 11.5-million oz above 1945, the postwar low, but 4.1-million oz short of 1940, the all-time peak (see table and chart).

Last year's 2.2-million oz rise was basically due to an increase in South African production. At some 20.1-million oz, the highest ever recorded, South Africa's output was 2.4-million oz above the previous year. Since 1952, when the current phase of expansion in South Africa's gold output began, production has expanded by some 75%. Last year's output was 5.7-million oz above 1941, the peak year of the previous phase of expansion.

South Africa accounted last year for almost two thirds of world gold output (excluding the USSR). Total production of all other countries actually declined somewhat. This was attributable principally to a fall in United States output by some 0.2-million oz to an estimated 1.6-million, based on data for the first nine months. Canadian output, at 4.4-million oz, remained at approximately the same level as during the past decade. Production in Ghana showed a further increase and was almost 50% higher than in 1956.

Russia's gold output last year remains a closely guarded secret. Various non-Russian estimates put production in recent years at 10- to 17-million oz annually, which would make the Soviet Union the world's second largest producer.

Mining costs in South Africa declined last year—for the first time since 1948. At the equivalent of $6.33 per ton milled during the first nine months of 1959, the average cost was 3% lower than in the comparable period of 1958 and about the same as in 1957. The average cost was $4.14 in 1950, the year following the devaluation of the pound, and had thus risen by 6% annually from 1950 through 1957. For an industry which must work at a fixed price for its product, last year's interruption in upward cost trends is a matter of great significance; one swallow is better than none but it cannot yet be regarded as an unmistakable sign of summer's arrival.

Profits, which began to increase in 1952, reached an all-time high in 1959. During the first nine months of the year, total working profits from gold and uranium rose to $237-million from $204-million during the same period of 1958. Working profits from gold alone amounted to $176-million, compared with $126-million during the comparable period in 1958. Dividends paid by all producers of gold and uranium during the first nine months of 1959 amounted to $87-million, against $78-million a year previous. The high dividend yields, as well as the generally favorable tax status accorded by South Africa to foreign investors, has encouraged further foreign investment in the industry.

Last year's rise in output and profits was mainly the outcome of a steady expansion in the native labor force and a further increase in the yield per ton of ore milled. In 1959, the quantity of ore milled declined for the third year in succession, but the yield per ton milled increased (by 6% during the first nine months of 1959), and was the highest in 25 years. These aggregates for the industry conceal, however, highly uneven results. For the second year in succession, the amount of gold produced by mines that are also uranium producers was larger than that from mines yielding gold alone. Gold and uranium producers in the Far West Rand and gold producers in the Orange Free State are thus faring much better than the older gold producers on the Rand,

International Gold Movements in Broad Perspective

(Millions of dollars)

	1959		1958
World (excluding USSR)			
Change in gold reserves	+ 800	(Estimated)	+ 700
United States			
Change in gold reserves	−1,078		−2,247
Change in short-term liabilities to foreigners	+1,336	(Jan.-Oct.	+ 974
Of which Centeral Banks and governments represented	+ 429	(Jan.-Oct.(	+ 748
United Kingdom			
Change in gold reserves	+ 50	(Jan.-Sep.)	+1,250
Gold purchased from U. S.	+ 350	(Jan.-Sep.)	+ 900
Change in dollar reserves[1]	+ 165	(Jan.-Sep.)	− 454
Germany			
Change in gold reserves	− 13	(Jan.-Nov.)	+ 97
Gold purchased from U. S.	0	(Jan.-Sep.)	0
Change in dollar reserves[2]	− 196	(Jan.-Nov.	+ 391
France			
Gold purchased from U. S.	+ 66	(Jan.-Sep.)	0
Change in dollar reserves[3]	+ 558	(Jan.-Oct.)	+ 176
Switzerland			
Change in gold reserves	− 109	(Jan.-Nov.)	+ 219
Gold purchased from U. S.	0	(Jan.-Sep.)	+ 215
Change in dollar reserves[4]	− 37	(Jan.-Nov.)	− 52
Belgium			
Change in gold reserves	− 114	(Jan.-Nov.)	+ 355
Gold purchased from U. S.	+ 39	(Jan.-Sep.)	+ 329
Change in dollar reserves[3]	+ 13	(Jan.-Oct.)	− 7
Netherlands			
Change in gold reserves	+ 82	(Jan.-Nov.)	+ 306
Gold purchased from U. S.	+ 30	(Jan.-Sep.)	+ 261
Change in dollar reserves[3]	+ 83	(Jan.-Oct.)	+ 147
Italy			
Change in gold reserves	+ 347	(Jan.-Aug.)	+ 634
Gold purchased from U. S.	0	(Jan.-Sep.)	+ 349
Change in dollar reserves[3]	+ 412	(Jan.-Oct.)	+ 48
Austria			
Change in gold reserves	+ 97	(Jan.-Nov.)	+ 91
Gold purchased from U. S.	+ 82	(Jan.-Sep.)	+ 84
Change in dollar reserves[3]	− 19	(Jan.-Oct.)	+ 62
Japan			
Gold purchased from U. S.	+ 167	(Jan.-Sep.)	0
Change in dollar reserves[5]	+ 23	(Jan.-Oct.)	+ 355
International Monetary Fund			
Change in gold holdings	+ 720	(Jan.-Sep.)	+ 152
Gold acquired from U. S.[6]	+ 164	(Jan.-Sep.)	+ 7

Countries are arranged in the order of the magnitude of gold reserves in 1959.

Dollar reserves: (1) Includes small amounts of other convertible currencies. (2) Official U. S. and Can. $ holdings. (3) U. S. dollar holdings by official institutions and commercial banks. (4) Official U. S. dollar holdings. (5) Reflects mainly U. S. additional gold subscription ($344 million) and gold sales by IMF to invest in U. S. Treasury bills ($200 million during Jan.-Sep.; additional $100 million was reportedly sold in Oct.).

Source: International Monetary Fund.

where the absence of higher grade ore brings about relatively low average yields and smaller profit margins.

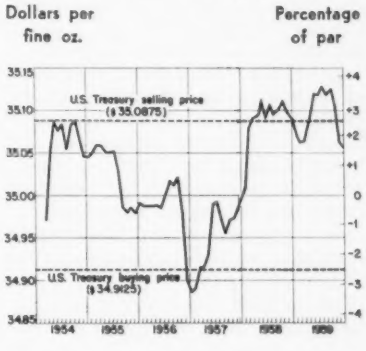
Subsidies paid to gold producers in Australia were increased last year; those in Canada had been raised in 1958. Such subsidization in these and certain other countries is designed to benefit marginal producers, the amount of subsidy being related — with the approval of the International Monetary Fund—to economic needs of various categories of mines, and subject to a number of conditions.

Total gold supply in 1959 was the largest in any postwar year. Gold output, at 32.6-million oz, was worth some $1,150-million. In addition, Russia reportedly sold at least $250-million worth of gold as against $210-million in 1958; like other countries, Russia sells gold to cover a deficit in international payments. Altogether, therefore, last year's gold supply may well have been of the order of $1,400-million, against some $1,300-million in each of the two preceding years.

At the year-end, it was too early to determine how much of the fresh supply of $1,400-million found its way into the stocks of central banks, governments, and international financial institutions. In 1958, according to the International Monetary Fund, some $700-million was added to official gold stocks and an estimated $600-million was absorbed by the arts and industries and by private hoards; this was about the same as the estimate for 1957. Data available as we go to press indicate that official monetary stocks may well have increased last year by as much as $800-million. The growing accretion of gold into official reserves to buttress international liquidity is a most encouraging development. It reflects, fundamentally, the high degree of monetary stability, exchange convertibility, and confidence in the national currencies of Western Europe.

Dollar Equivalent of London Gold Price

(Monthly averages)

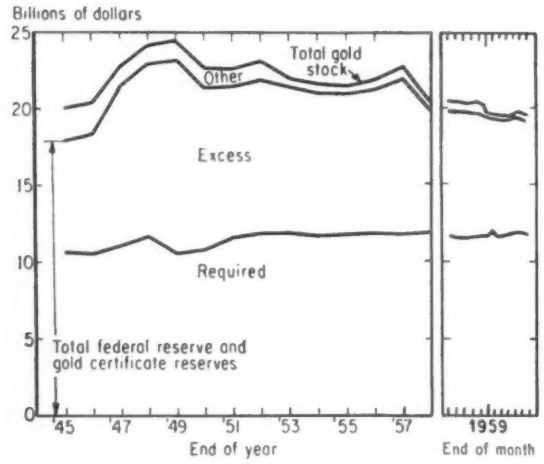


The London gold market handled the bulk of newly-mined gold. A better price could be obtained there than the U.S. Treasury's buying price of gold (see chart). Russian gold, which the U.S. Treasury is not buying, reportedly was marketed in London in much larger amounts than in earlier years; with the restoration of external convertibility of sterling at the end of 1958, Russia ceased to benefit from the favorable free market rates for transferable sterling on the Continent of Europe.

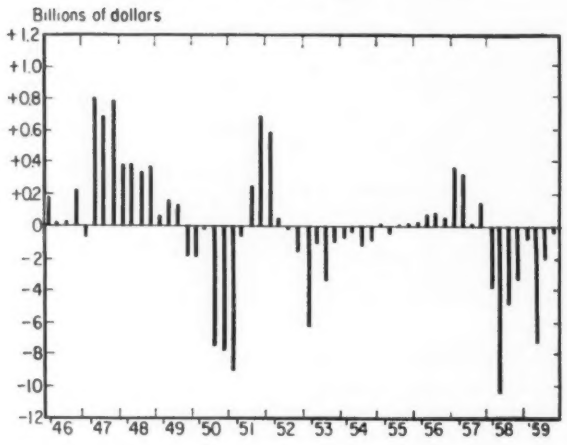
Sterling convertibility has also helped expand the bullion business in London since gold can now be purchased, by persons residing outside the United Kingdom and the overseas sterling countries, against the new "external account" sterling; previously, nonresidents could purchase gold only against American or Canadian account sterling or so-called "registered sterling," which could be acquired only for dollars. Gold purchases by sterling-area residents continue to be subject to license, which is granted only in limited amounts for industrial and artistic purposes.

Sales to central banks were an outstanding feature of last year's gold transactions in London. The demand stemmed mainly from Continental European banks. According to British financial commentators, the Bank of England intervened in the market

U.S. Gold Stock



Changes in U.S. Gold Stock



by selling considerable amounts of gold; in 1958, on the other hand, it had been a substantial buyer. Since sterling was strong during most of last year, official gold sales were not motivated, as in 1956 and 1957, by the need to acquire dollars to support the sterling-dollar exchange rate; rather, they aimed at keeping the market supplied to prevent an undue rise in the gold price. But, according to one London comment, the Bank of England was an unwilling seller of gold since it did not want to acquire dollars and convert them back into gold in New York.

Nevertheless, demand pushed the London market price for gold, expressed in U.S. dollars, above the U.S. Treasury's selling price. As shown in the chart, the average monthly price reached a peak of $35.13 in July but subsequently declined and stood at $35.05½ in December. It was, therefore, cheaper during much of the year for central banks to buy gold in New York than in London—at least for transactions in which shipping costs (about $0.14 per oz) were not involved. As will be noted below, the U.S. Treasury's gold stock declined last year by $1,078-million.

In countries where there are domestic gold markets, prices in local currencies, as converted into the dollar, are higher than the world price; but these premia reflect, basically, local factors such as monetary habits, political unrest or financial disorders — whether actual or anticipated, and the cost of overcoming hurdles impeding private flows of gold.

Private demand for gold remained last year at about the same level as in 1958. Altogether, some $600-million seem to have been consumed in arts and industry or absorbed in private hoards. Demand for gold in the Far East was reported larger than in 1958, but demand in the Middle East declined.

In the West, private demand for gold remained, on the whole, unchanged despite new arrangements made in a number of countries to facilitate the purchase and holding of gold. In Germany, the last limitations on domestic trade as well as on the export and import of gold were removed in January 1959. In Canada, the Toronto Stock Exchange began trading in gold bullion in February. The Union of South Africa announced in April that the South African Reserve Bank would sell to private purchasers outside the sterling area—against dollars or other convertible currencies — bar gold in minimum amounts of 25,000 fine oz ($875,000) for each individual purchase; the minimum was later reduced to 10,000 fine oz ($350,000). Prices bid must, however, be better than could be realized by shipping gold for sale in the London market.

Gold certificate schemes were initiated in late 1958 by a Canadian commercial bank, and in early 1959 by a British bullion house, a German commercial bank, and a South African bank; later, certificates issued by these four banks were made interchangeable, enabling holders to take delivery of gold in any of the four centers (with the proviso that payment for any difference in price between the markets would have to be made upon delivery). Issuance of another freely-negotiable certificate was announced last December by a South African corporation. This certificate contains a promise to deliver gold anywhere it is legal to do so. But investors have apparently shown little interest in these facilities.

Monetary gold stocks were up $800-million, as already noted. This aggregate conceals, however, two outstanding features of gold developments last year—a decline by $1.1-billion in U.S. reserves and a rise by some $1.9-billion in the official gold holdings of other countries and the International Monetary Fund (mainly because of the subscriptions to the Fund's enlarged quotas, 25% of which had to be paid in gold). These movements are summed up in the accompanying table.

The reason for U.S. gold sales was the deficit in the balance of payments of some $3.7-billion; in 1958, the deficit was $3.4-billion. Despite the rise in last year's deficit, however, the U.S. gold loss was $1.2-billion smaller than in 1958. The nations that acquired U.S. dollars in 1959—mainly Western Europe and Japan—kept the bulk of their earnings in dollars, enlarging their liquid dollar holdings by $1.9-billion during January-October 1959 (as against $0.6-billion during the same period of 1958). The high level of interest rates in the U.S. was undoubtedly an important factor in the continued dollar accumulation.

The largest buyers of U.S. gold were (in the order of the amounts purchased during the January-September period for which data were available at the year-end) the United Kingdom, Japan, Austria, and France. France bought no gold from the United States in 1958. On the other hand, Italy, Belgium, the Netherlands, and Switzerland, which

bought a total of $1,154-million from the U.S. in 1958, acquired only $69-million during January-September 1959. The United Kingdom accounted, both in 1958 and January-September 1959, for over one third of total gold purchases from the U.S. Germany bought no gold from the U.S. Treasury from 1956 through September 1959. Differences between changes in total gold reserves and gold purchased from the U.S. reflected, in large part, gold acquisitions in London.

At the end of 1959, monetary gold reserves held outside the U.S. (and outside Russia) stood at some $21-billion—twice as high as in December 1949, three months after the devaluation of sterling and many other currencies. Of this increase, $5.0-billion came from the U.S. and the remainder from new gold output, Russia, and other sources. At the same time, foreign countries added over $11-billion to their liquid dollar assets. Altogether, therefore, foreign gold and dollar holdings, now at some $40-billion, have increased by almost $22-billion in the past decade. The United States, which held 70% of world monetary gold stocks 10 years ago, now holds slightly less than one half.

Redistribution of gold is a good thing in so far as it measures the success of Europe, where most of the gold has gone, in stabilizing its currencies and rebuilding its industrial power. But in the past two years the build-up of Europe's reserves has involved increased costs to the U.S. evidenced in an external payments deficit of a size that no country, however rich, can afford indefinitely.

This excessive gold and dollar outflow from the U.S. has brought about an entirely new situation in world finance—and one that calls for a fresh examination of economic and financial policies, domestically as well as internationally.

At home, the United States is pursuing policies aimed at rebalancing the budget, restraining credit, and improving the structure of the public debt. All this is necessary, of course, for overwhelming domestic reasons, but the need to reduce the balance-of-payments deficit and maintain respect for the dollar clinches the case.

Internationally, the U.S. has successfully urged the elimination of direct quantitative restrictions on dollar trade and payments by countries with ample, if not overflowing, reserves. Meanwhile, there are signs that our merchandise exports are rising from their early-1959 lows as a result of the expanding demand abroad. In the industrial countries, this increased demand reflects the recovery from the 1958-59 business recession, and in the primary-producing countries the somewhat higher commodity prices and, hence, enlarged export earnings.

Much will now depend on the readiness of U.S. exporters to respond effectively to the expansion of foreign demand and on their ability to price American products competitively. Much will also depend on the removal of the remaining obstacles to trade — above all, tariffs (which in many countries are much higher than in the United States) and the potential discrimination against outsiders, including the U.S., implied in the new regional trading arrangements in Europe.

Moreover, other economically and financially developed countries, now that they have attained record levels of output and productivity, are able to contribute increasingly to programs designed to help the poorer parts of the world, and to assume heavier burdens of common defense.

It is worth noting that foreign officials and bankers are witnessing, as the President of the German central bank, Dr. Blessing, noted recently, "with keen satisfaction . . . the vigorous endeavors to maintain stability that are being made in the United States." He stressed that maintenance of monetary stability in the U.S. is "of tremendous importance" to other nations, since the dollar is "the leading currency of the world and one of the main pillars of our international currency system." A sound dollar, therefore, is not only a matter of interest to us but also fundamental to maintaining the economic and financial strength of the whole world.

The dollar, of course, remains a strong and desirable currency. As already noted, foreign bankers, traders, and investors continue to enlarge dollar balances and investments. There has been no "dollar panic." But the willingness of the outside world to hold dollars, rather than gold, must depend in large part on their confidence in our Government, the Federal Reserve System and the American people.

It is sometimes suggested that the gold position of the U.S. has become weak. Nothing of that sort has happened, however. At the end of 1959, gold required as legal cover for currency stood at $11.9-billion, leaving the U.S. with "free" gold of $7.3-billion (see chart) to cover short-term liabilities to foreigners. These amounted last October to $16-billion, of which $9-billion was on official account and thus eligible for conversion into dollars under a practice that the Treasury established some 25 years ago. The remaining $7-billion was held by banks, businesses, and individuals as working balances and reserves against liabilities to Americans; the privately held dollars cannot be converted into gold unless previously sold to the central bank of the country concerned. The United Kingdom held in December 1959 a gold and convertible currency reserve of some $3-billion. Sterling liabilities stood in June 1959 close to the equivalent of $10-billion; most of these were on official account.

Americans as well as foreigners are aware of the large real resources and the high productivity of our economy. But the economies of other industrial nations are once again strong; and the U.S., which a few years ago was easily able to square is accounts with the rest of the world, has now discovered that it is, like any other nation, subject to the balance-of-payments discipline. This, indeed, is the most striking lesson of world gold trends today. END

Lead

Robert L. Ziegfeld
Lead Industries Association

THERE WAS a decided improvement in the statistical position of lead in 1959. Consumption increased substantially, U.S. imports were curbed by the first full year of quota operation, and agreement was reached on voluntary production controls throughout the world. As a result, the top-heavy inventories carried at the beginning of the year, particularly by domestic smelters, underwent a major reduction. This improvement took place despite the fact that the effect of production cut-backs abroad was not felt until the year was well under way and that there were sizable increases in imports of manufactured lead products which were not covered by the quotas. A prolonged strike at plants of the largest domestic smelt-

U.S. Lead Supply and Demand

(Short tons)

	1959 estimated	1958
Supply:		
Mine production	**250,000**	267,377
Secondary production	**450,000**	401,800
Quota imports:[2]		
Ore, recoverable	126,000	202,088
Pigs and bars	222,000	**348,000**	368,452
Other imports (mainly for stockpile):		
Ore, recoverable	10,000	
Pigs and bars	50,000	**60,000**	
Total		**1,113,000**	1,239,717
Changes in stocks at primary smelters and refineries		**80,000** (decr.)	149,158 (incr.)
Total		**1,183,000**	1,090,559
Exports		**3,000**	1,359
Total available		**1,185,000**	1,089,200
Demand:		
Industrial consumption		**1,100,000**	986,387
Est. stockpile shipments		**50,000**	85,000
Consumers and secondary smelter stocks		**5,000** (incr.)	6,410 (decr.)
Unaccounted for		**30,000**	24,223
Total		**1,185,000**	1,089,200

[1] American Bureau of Metal Statistics, U. S. Bureau of Mines, and Lead Industries Association.

[2] Import quotas established Oct. 1, 1958.

U.S. Lead Use*

(Short tons)

	1959 estimated	1958
White lead	**12,700**	13,600
Red lead and litharge	**82,000**	64,900
Storage batteries	**370,000**	312,700
Cable	**65,000**	75,000
Building	**51,000**	48,100
Tetraethyl lead	**162,000**	159,400
Ammunition	**45,000**	40,200
Foil	**3,800**	4,600
Bearing metal	**22,700**	19,000
Solder	**70,000**	59,700
Type metal	**26,300**	26,700
Calking lead	**80,000**	70,800
Other uses	**109,500**	91,700
	1,100,000	986,400

*Based on U. S. Bureau of Mines statistics.

ing company and several other lead operations, however, did contribute to limitation of domestic supplies. Even though the market weakened on settlement of the major strike in December, the outlook for 1960 appears to be much more encouraging than at the beginning of 1959.

Supplies. Final figures for 1959 will probably show that lead supplies available to industry in the U.S. were reduced substantially as compared with 1958. Although secondary production increased about 12% to around 450,000 tons, mine production, largely because of strikes, was off from the 60-year low of 1958 to about 250,000 tons. Imports under the quotas were about 350,000 tons, with an additional estimated 60,000 tons entering mainly through barter for stockpile. Adding a reduction of about 80,000 tons in stocks at primary refineries and deducting exports of 3,000 tons, the total supply of lead in the U.S. was about 1,185,000 tons.

On the other side of the ledger, industrial consumption in 1959 increased more than 10% over 1958, rising to approximately 1,100,000 tons. Consumers and secondary smelters added about 5,000 tons of lead to their inventories during the year and, with stockpile shipments estimated at 50,000 tons, some 30,000 tons is left unaccounted for. Since 1947 industrial consumption has ranged between a low of 958,000 tons in 1949 and a high of 1,238,000 tons the following year, 1950, and has averaged about 1,135,000 tons. Thus in 1959 consumption was only slightly below the average.

The increase in 1959 consumption compared with 1958 was well distributed over lead's major uses with only cable sheathing showing a substantial decline. Battery consumption increased nearly 60,000 tons and remained the leading consumer by a wide margin. The number of replacement batteries sold hit an all time high of about 27-million, and total batteries sold were second only to 1955 when new car and truck sales were at a record of over 9-million. With new car production in 1960 expected to be substantially higher than in 1959, and with all new cars using 12-volt batteries as well as a higher percentage of replacements being these heavier batteries, lead consumption by this industry should be substantially larger in 1960, perhaps reaching 385,000 tons.

The quotas on imports which were established by the President in the fall of 1958 at 80% of the average for the years 1953 through 1957 were in operation for the entire year and were largely responsible for the reduction of some 150,000 tons in imports. At this time official statements indicate little likelihood of any change in quotas on lead ores or pig lead. However, since manufactured lead products, like lead oxide, pipe and sheet, are not controlled by quotas, there appears to have been a marked increase in imports of these products estimated at some 20,000 tons. Both domestic lead producers and manufacturers have made strong appeals to Washington to close this loophole, claiming damage to both segments of the industry.

Meanwhile, at Senate instigation, the Tariff Commission initiated a further study of the lead-zinc situation on which it will report early in 1960. It also rejected a request of six lead and zinc smelting companies for widening the scope of the hearings to include a report to the Administration on the grounds that the foregoing study was already being made.

Late in 1958 two international meetings of lead and zinc producing countries, sponsored by the UN, were held to appraise the situation and determine what, if any, international action might be taken toward rectifying the world over-supply. These culminated in a third such meeting in New York in April 1959, at which voluntary production curtailment was agreed upon. Another meeting is to be held in Geneva in late January 1960 for reappraisal of the situation at that time. Since the zinc market has been very strong recently, the question arises whether increased production of zinc might occur with a consequent possible increase in lead production.

Prices. An accompanying table shows the changes in the New York price for lead throughout 1959. After the imposition of quotas in the last quarter of 1958, the lead price had risen from 11c in September to 13c, where it opened 1959. Starting in January the price worked steadily lower, again reaching 11c, reflecting continued overproduction and not too heavy demand, along with immense inventories in the hands of refiners resulting in hand-to-mouth buying. After the last international conference in the late spring, the price again started upward and reached 13c in August immediately after the largest domestic smelter went on strike. Upon settlement of the strike in December, the price again suffered two ½c breaks and closed the year at 12c. Late De-

Lead Price Changes

(Cents per lb N. Y.)

Oct. 14, 1958	13.00
Jan. 22, 1959	12.00
Feb. 11	11.50
Feb. 20	11.00
Mar. 6	11.50
Apr. 1	11.00
Apr. 20	11.50
May 8	12.00
Aug. 24	13.00
Dec. 14	12.50
Dec. 21	12.00

cember buying at this price was improved, however.

Because of the insulation provided by quotas, the U.S. price and London price showed a greater spread throughout most of the year than the normal tariff and shipping costs. At the year end moderate strength in the London market and the reduction in the New York price brought the two closer together.

Summary of 1959. Although the lead price at the year end was somewhat lower than a year earlier, there are a number of encouraging factors. Manufacturers' inventories are comparatively low, and producers' stocks in the U.S. were reduced drastically. Stocks in the hands of producers abroad increased, but not nearly as much as domestic stocks were reduced, and production cutbacks abroad began to be felt late in the year. Actual industrial consumption has been good throughout the Free World. And during 1959 the intensive industry-wide research and market development programs, initiated in 1958, went into high gear. The industry, working together throughout the Free World, is showing a magnificent determination to put and keep its house in order.

Outlook. A further increase in lead consumption to perhaps 1,150,000 tons in 1960 is expected. Assuming continuation of quotas, that should result in a further reduction of producers' stocks since manufacturers are not in a position to draw much further from their own.

As already mentioned, storage batteries can look forward to another good year. The second largest use, tetraethyl lead, should increase moderately as it did in 1959. It is not expected that cable sheathing will decline further. As a matter of fact a research project, conducted jointly by the Lead Industries Association and a cable press manufacturer, was concluded in 1959 and resulted in a press of such design that it can continuously extrude cable sheathing of any of the lead alloys commonly used. This should place lead in a better competitive position because of lower costs, better quality, and ability to use a variety of insulating materials.

A generally higher level of industrial activity should result in greater use of such lead products as solder and bearing metals. New lead compounds or materials containing them show promise. Synthetic pearlescent finishes made of lead compounds are finding new applications daily. Among the latest is their use in plastic floor coverings and wallpaper, and they are also being considered for finishes on automobiles, where they have already been used on custom models, and on household appliances. A new steel chalk board is on the market having a lead porcelain enamel surface in several colors. Lead glazed brick and lead porcelain enameled aluminum are both gaining favor as building materials.

The fields of vibration and sound attenuation are receiving much attention by engineers and architects. Lead has long been used in a limited way to reduce the transmission of sound and vibration, but its great potentialities are just now becoming more widely recognized. For example, during the past year it was used for the first time in connection with air conditioning equipment. Research and market development programs now under way are expected to exploit lead's possibilities to the fullest.

Another potential new field of application is as nonsacrificial anodes in impressed current systems for the protection of ships, bridges, piers and other structures from destructive corrosion. A number of such installations employing lead-silver alloy anodes were made in 1959, and several technical publications on this subject appeared.

Use of lead as atomic shielding is bound to show significant growth. In 1959 the first atomic powered commercial ship, the Savannah, was launched, and with it over 500 tons of lead shielding went to sea.

It is impossible in this space to give more than a bare suggestion of how modern technology is affecting the use of lead. Some developments are more or less far in the future, but some, like those mentioned, are close at hand. While the year 1960 looks encouraging to the lead industry and should be a relatively prosperous one, the more distant future looks even more enticing. END

Magnesium

Dr. J. D. Hanawalt
Dow Chemical Co.

THE MAGNESIUM INDUSTRY in 1959 recovered nicely from the 1957-58 recession and made good progress in developing commercial structural uses for the metal.

Consumption of primary magnesium was about 44,000 tons, an increase of 25% from the previous year. Consumption in 1960 is expected to be on the order of 45,000 to 50,000 tons, but could go higher depending on how rapidly automotive industry usage of magnesium die castings increases.

The die-casting market was the principal area of development for magnesium last year. Industry gained further experience with the semi-automated magnesium die-casting process in several large-scale manufacturing operations, and a breakthrough into substantial usage apparently is not far off.

Success of this program would change the basic pattern of peacetime magnesium consumption from non-structural and military to structural and commercial.

In the recent past, military aircraft applications dominated the picture in structural use of magnesium. But this former mainstay has been progressively weakened since 1957, when the cutback in military aircraft procurement began to gather force. Magnesium has won good acceptance in missile design; but because of low production rates for most missiles, this market has not taken up the slack resulting from the decline in aircraft.

In addition to aircraft and missiles, magnesium's principal structural uses include luggage, military ground vehicles, portable tools, materials handling equipment, tooling jigs and fixtures, office machines, ladders and photoengraving plate. Alloying with aluminum is the chief non-structural application.

In terms of potential, tooling plate is one of the most promising of mag-

nesium structural uses outside the die-casting market. It is a use wherein magnesium's natural advantages of anneal-flatness, light weight, high-speed machinability and dimensional stability can be fully exploited and, on a volume equivalent basis, it costs substantially less than other lightweight materials of comparable flatness.

A variety of new structural applications is expected to result from the development of new magnesium products. For example, rolled and extruded forms that require no stress relief after welding are being used in bulk shipping containers, and are well suited to use in other large, lightweight structures. Previously, critical bends could not be made in magnesium without using heated dies. Now a special bending sheet eliminates the need for heated dies in bends to 2 t.

The same quality that has made magnesium an aircraft metal and now a missile metal—light weight—is causing it to receive increasing attention from designers of military surface vehicles. Magnesium wheels recently were specified for a second Army Ordnance vehicle.

The sizable inventories of primary magnesium pig and ingot carried over from 1958 were substantially reduced during 1959. The gap between production and consumption was narrowed somewhat as production rose to an average of about 3,000 tons per month. A new primary producer, Alabama Metallurgical Corp., opened its plant of 7,000 tons' annual capacity last fall and expects to achieve capacity operation early in 1960.

An outstanding event for the magnesium industry this year will be a joint technical meeting of the Magnesium Association of the United States and the Magnesium Industry Council of Great Britain. Sessions will be held in late May and early June in London and Manchester, England, and Wolfsburg and Hanover, Germany. In the latter cities, participants will observe manufacturing operations for the Volkswagen automobile, which uses about 38 lb of magnesium engine castings per vehicle. END

Silver

Francis H. Wemple
Handy & Harman

U.S. Silver Trade

(Millions of fine oz)

	1959	1958	1957	1956
Imported from:				
Canada	**22.3**	19.6	18.0	20.0
Mexico	**15.8**	20.6	16.5	18.9
Peru	**10.9**	15.6	13.1	11.4
Bolivia	**2.2**	3.4	3.5	5.5
Other Western Hemisphere countries	**6.0**	6.5	5.1	4.5
Total Western Hemisphere	**57.2**	65.7	56.2	60.3
United Kingdom	**.5**	.4	22.3	67.7
Netherlands	..	4.3	4.7	19.3
Other European countries	**.3**	.1	.1	..
India	—	82.0	89.5	..
Pakistan	**4.6**	5.7	30.3	..
Australia	**1.2**	1.5	1.7	11.5
All other countries	**2.8**	6.2	1.3	4.0
Total imports	**66.6**	165.9	206.1	162.8
Exported to:				
Mexico	..	1.5	1.3	1.7
United Kingdom	**2.3**	1	3.9	1.6
France	**1.2**	..	.1	..
West Germany	**3.1**	1.0	2.8	.3
All other countries	**2.2**	.1	2.2	1.9
Total exports	**8.8**	2.7	10.3	5.5

DEMAND THROUGHOUT THE WORLD increased substantially in 1959. In the arts and industries, increases generally reflected improved business conditions not only in the U.S. but in other countries as well. More silver, too, was used for coinage due principally to new programs in France and Italy. Production, on the other hand, was adversely affected by strikes, and as a result firm price conditions prevailed during most of the year.

Total U.S. consumption of silver in the arts and industries amounted to 100-million oz, an increase of about 18% over 1958. The amount used in the arts was up moderately, but the most significant increases were in the industrial field. Improvement in the production of consumer durable goods, including air-conditioning, refrigeration, automotive and electrical appliance industries, created a substantially better demand for silver in many different forms and alloys, such as solders and brazing alloys, electrical contact materials, and chemical products. There were also continuing increases in the use of silver for military purposes, particularly in aircraft, missiles and rockets. In addition to increases in the use of silver brazing alloys in these programs, there have been significant developments in the use of silver products in military electronics, including power sources, guidance mechanisms and radar.

U.S. demand for silver maintained a steady strength throughout 1959 with little seasonal fluctuations. The published price in New York went from a low of 89⅞c per troy oz at the beginning of the year to a high of 91⅝c on Aug. 28.

The first price change in 1959 was a ⅛c increase on Jan. 7 to 90c. Thereafter a gradual rising trend carried the published rate to 90⅜c by Jan. 20. At this level a portion of domestically mined silver came into the market, and for a time this became a point of stabilization.

Toward the end of February increasing pressure of demand was evident in the New York market, and higher prices soon resulted. Economic recovery in the U.S. and abroad was one element of the demand. Another factor was the newly announced French coinage program. Official information from France as to amounts involved in the program was not available at the time, but there were substantial inquiries in the market. Before long, U.S. manufacturers applied to the Mint for silver under the Act of July 31, 1946 for the first time in almost two years, and on March 4 the New York price went up to 91⅜c based on the delivered cost of Treasury silver from the Mint in San Francisco.

For the balance of the year, domestic consumers periodically bought Treasury silver in varying amounts to fulfill their requirements, and except for a short period in August, the N.Y. published price remained unchanged. On Aug. 28 the quotation increased ¼c to 91⅝c and held at that level until Sept. 3, when it reverted to 91⅜c. There were two reasons for this temporary adjustment; one was a trucking strike in the San Francisco area, and the other was the price schedule of the U.S. Mint. Under the Act of July 31, 1946 the Treasury has established selling prices at 91c delivered at the San Francisco Mint, 91½c delivered at the Denver Mint and 92¼c delivered at the N.Y. Assay Office. With San Francisco cut off by the strike, manufacturers in the East bought silver from the Denver Mint at a ¼c increase in the delivered cost in New York. However, the trucking strike was settled in a few days, and buyers again had access to the Mint at San Francisco.

Another strike of much greater sig-

World Silver Statistics (Partial)

(Millions of fine oz)

	1959	1958	1957	1956	1955
Production:					
Mexico	**43.2**	47.6	47.1	43.1	48.0
United States	**24.0**	36.8	38.7	38.7	36.5
Canada	**32.9**	31.1	28.8	28.4	28.0
Peru	**24.0**	24.2	24.8	23.0	22.9
Bolivia	**6.0**	6.0	5.4	7.5	5.9
Other South and Central American countries	**7.5**	7.6	6.8	7.1	6.2
Total Western Hemisphere	**137.6**	153.3	151.6	147.8	147.5
Outside the Western Hemisphere (partial)	**58.0**	58.0	53.0	51.7	50.9
World production (partial)	**195.6**	211.3	204.6	199.5	198.4
Consumption:					
Arts and Industries:					
United States	**100.0**	85.0	95.0	100.0	100.0
Canada	**4.4**	3.9	5.8	3.8	4.6
Mexico	**5.4**	4.4	3.1	2.9	2.5
Great Britain	**17.5**	13.5	14.7	13.9	14.2
France	**10.6**	13.0	17.9	15.9	15.7
Western Germany	**33.3**	31.1	37.0	33.1	28.1
India	**2.0**	3.3	15.0	17.5	3.0
Japan	**13.6**	8.2	8.2	8.1	6.3
Other countries (partial)	**25.0**	25.0	16.3	15.0	18.4
Total (partial)	**211.8**	187.4	213.0	210.2	192.8
Coinage:					
United States	**40.7**	36.2	52.0	31.2	8.2
Canada	**5.7**	4.7	3.8	3.2	2.6
Mexico	**1.4**	2.2	3.1	4.9	2.3
France	**6.4**	..	..	..	..
Saudi Arabia	..	..	..	..	17.2
Other countries (partial)	**30.0**	20.0	25.3	17.2	22.3
Total coinage (partial)	**84.2**	63.1	84.2	56.5	52.6
Total consumption (partial)	**296.0**	250.5	297.2	266.7	245.4

Treasury Silver

(Millions of fine oz)

	Dec. 31 1959	Dec. 31 1958	Dec. 31 1957	Dec. 31 1956	Dec. 31 1955
Held in Treasury:					
Securing Silver Certificates:					
Silver bullion	**1741.3**	1736.3	1711.5	1708.4	1697.2
Silver dollars	**141.1**	156.8	169.4	182.8	196.1
Subsidiary coin	**2.4**	10.9	5.9	2.0	11.3
Free silver bullion	**175.1**	202.2	127.4	87.4	24.9
Total Treasury stocks	**2059.9**	2106.2	2014.2	1980.6	1929.5
Outside the Treasury:					
Silver dollars	**236.2**	220.8	208.3	195.1	182.0
Subsidiary coin	**1094.6**	1046.2	1014.6	968.0	928.3
Total Silver outside the Treasury	**1330.8**	1267.0	1222.9	1163.1	1110.3
Total silver	**3390.7**	3373.2	3237.1	3143.7	3039.8

nificance to the silver market was a strike at major copper refineries which lasted from August to the middle of December. U.S. production facilities were severely limited during the period, and very little silver was available. Export of Treasury silver is prohibited, and prices in other centers during the closing months of the year exceeded the New York rate by premiums of ½c to 1c an oz. In spite of this differential, shipments from the U.S. were small because of the shortage of exportable silver. On the other hand, silver from other producing countries, normally sold in the U.S., was diverted to more advantageous markets.

Total U.S. imports during 1959 amounted to about 66.6-million oz. Excluding returns against lend-lease, in the amount of 5.4-million oz, the balance of 61.2-million oz was about 17% below the comparable 1958 figure. Imports from Canada amounted to 22.3-million oz, an increase of about 14% over 1958, while imports from all other countries were lower. About 15.8-million oz were received from Mexico, a 23% decline from 1958; from Peru 10.9-million oz, about 30% below the previous year's figure; receipts from Bolivia also were sharply lower and amounted to 2.2-million oz; from all other Western Hemisphere countries 6-million oz were received, about 8% below the previous year. From countries outside the Western Hemisphere 4.8-million were received, excluding lend-lease returns.

Total U.S. exports of silver in 1959 were about 8.8-million oz. Shipments to Western Germany amounted to 3.1-million oz; to the U.K. 2.3-million; to France 1.2-million; and to all other countries combined 2.2-million oz.

Progress was made during 1959 toward completion of the return of lend-lease silver, but 35.1-million oz still remain outstanding. Under arrangements previously agreed upon, Pakistan returned 4.6-million during the year, and the balance of 13.8-million oz is to be returned in three similar annual installments. The small balance remaining outstanding for Ethiopia at the end of 1958, amounting to 800,000 oz was cleared in the course of 1959. No returns have been received from Saudi Arabia.

Non-monetized Treasury silver stocks generally known as free stocks amounted to 175.1-million oz at Dec. 31, 1959, a drop of 13% during the year. It is from these stocks that silver is obtained for coinage requirements and for sales to domestic industry under the Act of July 31, 1946.

In addition to the 35.1-million oz of lend-lease silver still outstanding, as

Silver Quotations

	New York Price			London Spot		
	High	Low (Cents)	Average	High	Low (Pence)	Average
1959	91.625	89.875	91.202	80.250	75.875	78.818
1958	90.375	88.625	89.044	78.750	74.750	76.211
1957	91.375	89.625	90.820	80.500	77.125	78.927
1956	91.625	90.000	90.826	81.375	76.625	79.132
1955	92.000	85.250	89.099	80.250	73.750	77.507
1954	85.250	85.250	85.250	74.375	72.000	73.482
1953	85.250	83.250	85.188	74.000	72.875	73.945
1952	88.000	82.750	84.941	77.000	72.500	74.360
1951	90.160	80.000	89.368	78.500	70.000	77.856
1950	80.000	71.750	74.169	70.000	63.000	64.796

noted earlier, about 24.3-million oz have been received by the Treasury but not yet credited to the free stocks account, pending final verification. This makes a total of 59.4-million oz of lend-lease silver ultimately to be credited, assuming Saudi Arabia's obligation is satisfied.

World consumption of silver in 1959 in non-Communist countries amounted to about 296-million oz, an increase of 18% over 1958. Use in the arts and industries amounted to about 211.8-million oz, an increase of 13%, and use in coinage amounted to about 84.2-million oz, an increase of 33% over 1958. In the arts and industries, the largest volume increase was recorded in the U.S., but Japan with a 66% gain, U.K. with a 30% gain and Mexico with a 23% gain registered the highest relative improvement over the previous year. In coinage, increases were noted in many countries, and new programs in France and Italy added to the rising trend.

The French coinage program consists of two denominations, a new five-franc coin, and a new two-franc coin, equivalent to 500 francs and 200 francs, respectively, of the old currency. The five-franc coin weighs 12 grams, is 0.835 fine and contains 0.32 oz of silver. The two-franc coin weighs 8.5 grams, is also .835 fine and contains 0.23 oz silver. As yet only the five-franc coins have been minted. The program presently calls for the use of a total of 58-million oz of silver over the next few years, and about a six months' supply is currently in hand.

The Italian program was authorized in 1958 and provides for a 500-lire coin weighing 11 grams. It is 0.835 fine and contains 0.30 oz of silver. A total of 24-million oz is involved, and the minting is about half completed. No silver has been purchased by the Italian Treasury for the coins inasmuch as sufficient stocks were on hand at the start of the program.

Total production of silver in the non-Communist world amounted to about 195.6-million oz, down 7% from the previous year. Most of the decline was accounted for by the U.S., where production was curtailed by strikes. Outside the Western Hemisphere, a total of 58-million oz is estimated, unchanged from 1958. This includes 16-million produced in Australia, about 9.3-million in Japan; and the balance in other countries.

If forecasts prove accurate, business activity in general will continue at high levels, and under these conditions the present rate of silver consumption should be maintained. However, it seems probable that resumption of normal production after the long strike of the past few months will result in less need for Treasury silver by industry. Assuming no change in the policies of the U.S. Government, the pattern of price stability of the past several years should continue. END

Aluminum

Irving Lipkowitz
Reynolds Metals Co.

ALL-TIME production records were established by the domestic aluminum industry in 1959 with a primary output of 1,945,000 tons. This was 24% higher than in 1958 (1,566,000 tons) and 16% above the previous production peak, 1,679,000 tons, reached in 1956.

Production records are far from a new experience for the domestic aluminum industry but the 1959 achievement is significantly different. It is the first peak to be set without taxing the industry's full capacity at any time during the year. The six domestic primary producers began 1959 with 2,194,250 tons of capacity and increased it to 2,402,750 tons by the end of the year (see table below).

The industry's 1959 rate of primary production, with variations among the individual companies, averaged 84%. During the year the production rose from about 80% in the first quarter to a little over 90% in July and dropped back to the 80% level by the end of the year.

The 1959 production record was achieved despite the sharp drop in primary shipments to the Government, pursuant to the producers' "put" right under their Korean War mobilization expansion contracts. In 1958, 323,128 tons, 20% of that year's production, were delivered to the Government under the "put" rights. During the first 10 months of 1959, 63,552 tons were "put" to the Government, less than 4% of production. Only one primary producer still has "put" rights outstanding, amounting to 54,000 tons a year.

Canadian production totaled about 600,000 tons during 1959, about 5% less than in 1958. The 1959 output was at about 70% of Canada's installed capacity (860,000 tons) but by the end of the year the production rate had risen to 80%, reflecting improved world market conditions.

The eight North American producers began 1960 with the following production potentials, beyond their presently operating facilities: (thousands of tons)

Type of primary capacity:	U. S.	Can.	Total
Completed (idle, or not yet activated)	491	200	691
Under construction (completion deferred)	202	240	442
Additions (planned only)		390	390
Grand total			1,523

This added output would make possible a North American production of 4,043,000 tons a year, 59% more than the 1959 total.

Elsewhere in the world, there was also an increase in primary production during 1959, but at a slower pace than in previous years. Soviet bloc production was up 16% during 1959, to 1,029,000 tons against 885,000 tons in 1958. Western Europe produced 788,000 tons, about 9% more than in 1958 (725,000 tons). All the rest of the world, including Japan, showed an increase in output from 168,000 tons in 1958 to 210,000 tons in 1959. As a result, world production rose 15%, from 3,978,000 tons in 1958 to 4,567,000 tons in 1959.

The U.S., with the largest and sharpest production increase during

U.S. Aluminum Foreign Trade, 1957-59

(Thousands of tons)

	Unfabricated (Primary and scrap)			Semi-Fabricated (Sheet, foil, rod, etc.)		
	Imports	Exports	Net imports	Imports	Exports	Net imports
1957	238.4	46.1	192.3	21.4	21.6	−0.2
1958	265.2	71.6	193.6	30.8	15.9	14.9
1959	**246.0**	**133.0**	**113.0**	**55.0**	**14.0**	**41.0**

1959, regained most of the margin it had lost in 1958. The U.S. share of world production was 43% in 1959, compared to 40% in 1958 and 44% in 1957. The Soviet bloc maintained its rank in 1959 as the second largest producing area, with 22% of the world's output, the same as in 1958. Western Europe showed a slight decline, from 18% to 17%, and Canada dropped from 16% to 13%.

The 1959 supply was ample to meet all market requirements, in the U.S. and elsewhere in the Free World. Idle primary capacity in North America throughout the year indicates that the ability to supply aluminum exceeded the demand.

The total U.S. supply, from all sources, was 2,635,000 tons in 1959 —another record. It was 21% higher than in 1958 (2,184,000 tons) and 12% above the previous peak of 2,349,000 tons in 1956.

The 451,000-ton increase was the result of the larger primary production and scrap supply. Primary imports were slightly lower in 1959 than in 1958 and accounted for a smaller share of the 1959 supply, about 9%.

Shipments to consuming industries were also at a record level and registered an even greater gain than production or supply. Total shipments to domestic and export markets amounted to 2,425,000 tons, 36% higher than in 1958 (1,786,000 tons) and 18% above the previous peak (2,055,000 tons in 1956. Please see table).

The major reason for the strong pickup since 1958 is increased domestic consumption. Since the recession affected the 1958 and 1957 shipment totals, 1959 was the first full year since 1956 which was free of recession influence. Another factor, during the second quarter, was inventory buying in anticipation of expected price increases and of a possible strike after the July 31 expiration of the industry's wage contracts.

Although shipments for the year as a whole showed an unquestionably strong advance over any previous year, there was a sharp drop in shipments during August. They recovered, however, in succeeding months. The industry's success in avoiding a strike and plant shutdown largely explains the temporary dip in shipments. When Aug. 1 brought a truce between labor and management, rather than plant shutdowns, there was both a cessation of further inventory building and some living off inventories already accumulated against such a development. The short-lived downturn, despite the concern expressed by some outside the industry, did not mark a levelling off or end of market growth.

Primary Aluminum Capacity

(Short tons)

	1959	1958
Alcoa	798,250	798,250
Reynolds	701,000*	601,000
Kaiser	609,500	537,000
Anaconda	60,000	60,000
Harvey	54,000	54,000
Ormet	180,000	144,000
Total	2,402,750	2,194,250

*Includes 66,700 tons of newly completed capacity—not yet activated.

United States Aluminum Supply

(Thousands of tons)

	1959 Estimated	1958
Primary		
Domestic	1,945	1,566
Imports	235	255
Scrap (recoverable content)	455	363
Total	2,635	2,184

Shipments, By Product

(Thousands of tons)

	1959	1958	Increase
Sheet, coil, plate	750	577	30%
Pig & ingot for castings & destructive uses	744	487	53%
Extrusions & tubing	539	411	31%
Wire, cable, rod, bar	223	173	29%
Foil	126	100	26%
Other	43	38	13%
Total	2,425	1,786	36%

Prices. The general improvement in aluminum market conditions, both domestic and foreign, also brought improvements in some prices. During the first half of 1959, primary and mill product prices were frozen under commitments made in December 1958 by major producers not to raise prices during that period. At the end of the period, primary prices were firmed up by the elimination of freight allowance practices which enabled some buyers to realize discounts on their primary purchases.

In December, domestic base prices for primary aluminum were restored to the 26c level which had been established in August 1957 and prevailed until April 1, 1958. At that time, the world price was cut 2c a lb, and so was the U.S. price, bringing the domestic base price down to 24c a lb. In August 1958, there had been a domestic price change, to 24.7c, after an automatic wage increase had gone into effect Aug. 1. The December action, bringing the domestic base price back to the 26c level, came shortly after the world market price had made a partial recovery, three quarters of a cent, to a new level of 23¼c. Aluminium Limited of Canada had initiated this move and other producers, including those in the U.S., took similar action shortly thereafter.

Semi-fabricated aluminum prices varied in strength during the year. The pressures of imports and domestic competition have kept some of these prices relatively weak. Some of the efforts being made to penetrate galvanized steel markets, particularly in the construction field, have also resulted in lowered prices.

Labor. The year 1959 marked the signing of a new three-year labor-management contract between the United Steelworkers of America and the principal aluminum producers. This event had many significant features. Most important was the fact that aluminum preceded steel in reaching a labor settlement. It had long been traditional for aluminum labor contracts to follow steel in point of time and to be patterned in a general way on the "steel formula." The aluminum contracts usually expired July 31 while the steel contracts expired a month earlier, June 30. This year, when the steel strike began, the Steelworkers and the principal primary producers agreed on a truce whereby operations would continue until a month after the steel dispute was settled or Nov. 1, whichever came earlier. It was also agreed that any settlement would be retroactive to Aug. 1. With the steel deadlock unbroken on Nov. 1, negotiations between the union and the aluminum producers were subsequently resumed and a settlement was announced Dec. 19.

The new contract again covers a three-year period, expiring July 31, 1962 and, as previously agreed, is retroactive to Aug. 1. It provides for wage and fringe benefit increases which the union estimates as amounting to 30c an hour, over the three-year period. Two of the companies estimated that the new contract meant an average added cost of 28.5 to 28.7c per hour. Most of the increase is in hourly wage rises. One company estimates the hourly wage

increases at 4.8c an hour during the first year, 7.1c the second year and 8.9c the third year.

Foreign trade. Foreign trade in the aggregate was greater than ever before in the industry's history, exceeding even the peaks reached under the extraordinary pressures of World War II and Korean War demands. But even more important than the total tonnages of imports and exports combined, is the different trends developing at the raw material (primary and scrap) and the semi-fabricated levels. Although in both groups, imports exceed exports, in 1959 primary and scrap exports rose sharply while the semi-fabricated group showed the sharpest gain on the import side. (See table).

The contrast between the two major types of aluminum products is striking. Net imports of primary and scrap were about 41% less in 1959 than the average for 1957 and 1958. On the semi-fabricated side, 1959 net imports were 458% more than the 1957-58 average.

These opposite trends within the industry's foreign trade reflect the same world market development: the rapid growth, in size and competitive strength, of semi-fabricated aluminum industries in Western Europe and Japan. Those areas are consuming much more primary and scrap than they can produce and conversely produce more semi-fabricated aluminum than they consume at home. This explains the sharp rise of our primary and scrap exports and the reduced flow of foreign primary and scrap to our market. These countries have been buying from us increasing amounts of the raw materials they use (primary or scrap) and selling back to us ever larger tonnages of the semi-fabricated and finished aluminum products.

As a result of this trend, semi-fabricated imports have been rising at a very sharp rate—much steeper than the rise in domestic shipments. Since 1955, the average annual growth rates (per year) have been:

	Domestic shipments	Imports
Sheet, circles, rod, bar, etc.	4¼%	34½%
Foil	6¾%	39¼%

The contrast between the rise in imports and in domestic shipments has been particularly strong during the past two years. Imports took 13% of the 1957-59 market growth in sheet, circles, bar and rod even though it had only 2.9% of the 1957 market. In foil, 11% of the market growth went to imports despite a participation in the 1957 market of only 1.7%.

Imports continue to be concentrated, both as to product and destination. This is particularly true for semi-fabricated aluminum imports, which are heavily concentrated in such items as common alloy coils, circles, screw machine rod, and plain, unmounted foil. During 1959 about three-fourths of all semi-fabricated imports entered the U.S. through New York, Boston or Philadelphia.

During 1959, major U.S. producers further extended their foreign operations through additional affiliations with fabricating companies in Western Europe, Japan and Latin America. Aluminium Ltd. made its first acquisition of operating facilities in the U.S. when it acquired the assets of Apex Smelting Co., the largest secondary smelting company.

Outlook. The predictions for 1960, from industry and Government alike, have been optimistic as to supply and demand. The supply is expected to be adequate to meet all demands, domestically and internationally. Estimates of 1960 shipments by the domestic industry indicate increases over 1959 ranging from 10 to 20%. All of the industry's major markets are expected to continue their growth: construction, automotive, electrical, appliances and packaging. In each case, reliance is placed not only on the existence of generally good business conditions but also on aggressive marketing to promote new uses and wider acceptance of aluminum products.

As to the competition between aluminum and other materials, no letdown is indicated for 1960. If anything, industry-to-industry competition is likely to be more intense. The domestic industry will also be faced, in all probability, with a continued rise in imports, particularly of semi-fabricated and finished aluminum products.

The favorable outlook for 1960 is essentially based on the industry's confidence that it can successfully meet these competitive challenges, just as it has in past years. The industry's product and market development efforts, being carried on in a bigger way than ever before, indicate that it is not relying on any national rate of growth to carry it to its 1960 objective but rather on what it itself can do. END

Uranium

James W. Franklin
Engineering & Mining Journal

THE URANIUM-PRODUCING industry continued its vigorous growth in 1959, despite the fact that the "day" of a large consumer market now seems to be even more distant. Generally speaking, Free World ore reserves, ore and concentrate production were up from last year. In the case of Canada and possibly the Union of South Africa, 1959 will represent a peak year in the industry's history.

1960 will be a good year for the U.S., the Belgian Congo, Australia and those South Afrikanders with contracts running through 1966; but for the Canadians and those South Africans considering stretch-outs, 1960 will be a most difficult time.

The U.S. continued to buy most of the Free World's output and as of July 1, 1959 had purchased 125,980 tons of contained U_3O_8 since 1943. According to Uranium Institute calculations, about two-thirds of the total amount was purchased from foreign mines (which were the only sources of uranium for a long time).

The latest data show Canadian producers were paid an average of $10.77 per lb and other foreign miners an average of $11.75 per lb. In the first half of 1959, the AEC paid an average of $8.99 per lb for domestic oxide. In fiscal 1959, the AEC purchased 15,160 tons of oxide from domestic miners and 18,170 tons from foreign sources for a total of 33,330 tons. In 1960, the domestic share will continue to rise, but Canada's and South Africa's share will begin to decline as the stretch-outs take hold.

U.S. ore and concentrate production, and ore reserve figures, continued to rise as the U.S. added several new mills, expanded contracts on others and continued to work out contract extensions for the domestic industry until the end of 1966.

Ore production rose from 5.1-million tons in 1958 to an estimated 6.9-million tons in 1959; in 1960, the estimate is still higher, 7.2-million tons.

Concentrate production rose from

U.S. Uranium Mills, Location and Capacity

Company	Location	Ore capacity (tpd)
Anaconda Co.	Grants, N. M.	3,500
Climax Uranium Co.	Grand Junction, Colo.	330
Dawn Mining Co.	Ford, Wash.	400
Gunnison Mining Co.	Gunnison, Colo.	200
Homestake-New Mexico Partners	Grants, N. M.	750
Homestake-Sapin Partners	Grants, N. M.	1,500
Kermac Nuclear Fuels Corp.	Grants, N. M.	3,300
Kerr-McGee Oil Industries	Shiprock, N. M.	300
Lakeview Mining Co.	Lakeview, Ore.	210
Lucky Mc Uranium Corp.	Riverton, Wyo.	980
Mines Development, Inc.	Edgemont, S. D.	400
Phillips Petroleum Co.	Grants, N. M.	1,725
Rare Metals Corp. of America	Tuba City, Ariz.	300
Susquehanna-Western, Inc.	Riverton, Wyo.	500
Texas-Zinc Minerals Corp.	Mexican Hat, Utah	1,000
Trace Elements Co. (Union Carbide subsidiary)	Maybell, Colo.	300
Union Carbide Nuclear Co.	Rifle, Colo.	1,000
Union Carbide Nuclear Co.	Uravan, Colo.	1,000
Uranium Reduction Co.	Moab, Utah	1,500
Vanadium Corp. of America	Durango, Colo.	750
Vitro Uranium Co.	Salt Lake City, Utah	600
Western Nuclear Corp.	Jeffrey City, Wyo.	845
Federal-Radorock-Gas Hills Partners	Riverton, Wyo.	522
Globe Mining Co. (Union Carbide)	Casper, Wyo.	492
		22,404

12,300 contained tons of U_3O_8 in 1958 to an estimated 16,330 tons in 1959; in 1960, the estimate is still up, about 17,000 tons. At the same time, and despite the fact that newly discovered ore cannot be mined under existing contracts, domestic ore reserves continued to rise. In 1958, ore reserves were set at 81.9-million tons. In July 1959, the U.S. AEC estimated reserves at 88.9-million tons. In 1960, the estimate will climb even further (the present estimate does not include the 3-million ton, 0.5% U_3O_8 orebody discovered in the Shirley Basin of Wyoming by Utah Construction & Mining Co.).

By the end of January 1960, all uranium mills currently contracted for —24 in all—were in production with a daily contract capacity totaling 22,404 tons. The total maximum capacity at which the mills could operate is far in excess of this figure. The actual operating rate is somewhat less than 22,404, since at least one mill is operating at less than contract capacity (Anaconda Co.).

The AEC announced that Monticello would be closed in January 1960 and Uranium Reduction Co. added a $3-million alkaline leach R-I-P circuit. Moab will be able to treat the types of ore formerly handled at Monticello.

Two additional processing mills are in the offing and two others a possibility. In allotting the additional milling capacity in 1958, the AEC authorized a 200-tpd mill for the Colorado Front Range (Cotter Corp. will operate a 200-tpd mill at Canyon City) and a 600-tpd mill for Duvall County, Texas (Columbia-Southern and Susquehanna Corp. are negotiating for final contract). In addition, an allotment for 200 tpd was set aside for the Austin, Nev. area and another 600 tpd given over to the lignite deposits in North and South Dakota. No contracts have been announced.

U.S. Uranium Ore Reserves By State

State	Short tons*	Grade U_3O_8
New Mexico	57,000,000	0.26%
Wyoming	15,000,000	0.34%
Utah	5,900,000	0.35%
Colorado	4,500,000	0.30%
Arizona	1,600,000	0.33%
Washington, Oregon and Nevada	2,500,000	0.26%
Texas, California, Montana, Idaho and Alaska	1,800,000	0.23%
North and South Dakota	600,000	0.27%

* Data are to July 1, 1959. Wyoming data can be raised by 3-million tons, 0.5% U_3O_8 due to Utah Construction & Mining Co.'s Gas Hills discovery. Table includes only orebodies whose ore is metallurgically amenable by present methods.

Western Nuclear's contract was extended to the end of 1966 and amended from 400 to 845 tpd in February 1959. Federal-Radorock-Gas Hills Partners got a mill contract in April and put a 522-tpd mill (contracted until the end of 1966) onstream in December 1959 near Riverton, Wyo. Lucky Mc Uranium Corp. got a contract extension until the end of 1966 and an amended tonnage from 833 to 980 tpd.

In May, the AEC signed a contract with Globe Mining Co. for a 492-tpd mill in Natrona County, Wyo. and the mill went into production in January 1960 (contract extends to the end of 1966). Uranium Reduction Co.'s contract was extended to the end of 1966 without a tonnage change (still 1,500 tpd) and Moab added the alkaline leach circuit (see E&MJ, October 1959, p 105-106 for flowsheet). Kerr McGee Oil Industries at Shiprock, N.M. got its 300-tpd contract extended, but only until June 30, 1965. At the end of the year, eight mills had contracts to the end of 1966, Kerr McGee until June 1965, and the rest still remained to be negotiated.

Both the U.S. Public Health Service and the AEC announced and warned the industry about radiation hazards and violations of safety regulations in the mines and mills. Assistant Surgeon General Price called attention to the fact that fully two-thirds of the domestic mines had radiation and/or dust levels in excess of assumed safe limits.

In July, the AEC cited Union Carbide, Vanadium Corp. of America and Vitro Uranium Co. for radiation safety violations, instructing the firms to clean up the mills, reduce dust conditions and reduce the toxic level of mill effluents (AEC release dated July 30, 1959, No. 240). The same order instructed Uranium Reduction Co. to submit its plans for complying with the safety regulations in its contract with the AEC.

In November, AEC issued further instructions to five millers to correct violations — Union Carbide, Rare Metals, Dawn Mining Co., Gunnison Mining Co. and Mines Development. In some cases the violations were minor omissions such as the failure to post warning notices. In others, the infractions were more severe—failure to conduct monitoring of radiation levels, and permitting unsafe radiation and dust levels to exist in and around the mills.

Then in November, on the 6th, the AEC "dropped the other shoe" in one of its now famous and annual November pronouncements—the Canadian

Uranium Ore Reserve Estimates

Country	Short tons of ore	Grade
United States	88,900,000*	0.28% U_3O_8 to July 1, 1959
Canada	328,000,000*	2.4 lb U_3O_8 to late 1959
Union of South Africa	1,050,000,000*	0.5 lb U_3O_8 to end of 1959
Australia	10,000,000	0.15% U_3O_8 in 1958
Belgian Congo	1,700,000	0.35% U_3O_8
Japan	1,500,000*	0.05% U_3O_8 to Nov. 1959
India	15,700,000	0.3% U_3O_8
Sweden	3,000,000,000*	0.35% U_3O_8 end of 1959
West Germany	300,000*	0.1% U_3O_8 to end 1959
Italy	3,000,000	0.2% U_3O_8 in 1958
Finland	100,000*	0.2% U_3O_8 to end of 1959
Argentina	300,000	0.1% U_3O_8
The French Community		
Metropolitan France	50,000	tons contained U*
Gabon	5,000	tons contained U*
Madagascar	500	tons contained U*
Spain	1,500	tons contained U

*Those figures followed by asterisk indicate official estimates furnished in response to E&MJ questionnaire. All others are unofficial. For further details of ore reserves, see tables in 1959 February annual review, p 120.

option had been dropped (see Canadian developments below), and followed this decision with one to end the bonus payment for ore development on April 18, 1960. As far as the domestic uranium industry was concerned, 1959 was a good year and the AEC was praised for taking action to preserve the future of the U.S. uranium-producing industry.

In Canada the news that the U.S. AEC would not renew the option on Canadian production came as a shock to many, particularly to those who in the past few years had purchased homes in the "towns of the future" —Beaverlodge, Bancroft and Elliot Lake. The Canadian uranium mining industry employs 14,000 men directly and another 70,000 indirectly. These people had no idea that the U.S. would drop the option. Neither, apparently, did the mining companies.

On March 12, Trade Minister Churchill said . . . "every possible step will be made in the course of the next few months [to get the U.S. to take up the options]."

On March 15 Liberal leader Lester Pearson said that he hoped that Washington will not point to U.S. production and say "we no longer need your help [Canada's] . . . thank you very much."

Later in the spring, the 1959 Uranium issue of Nuclear Energy Research Bureau said "the U.S. has a moral obligation, at least, of providing some sort of continued existence for this industry which it fostered. It is inconceivable to us that a country such as the U.S., ever conscious of our "good neighbor policy" will allow an industry which it has itself fostered, to dwindle into decay and turn so many thousands out of employment."

At the Wyoming Mining Association meeting, Jesse Johnson said "The long-range concern is over a possible uranium shortage, not an over-supply . . ."

On May 5, Chairman J. A. McCone said before the National Press Club in Washington, D. C., "In the purchase of ore, we will meet every past commitment made to producers when ore was scarce and the Government encouraged the mining industry to search for and develop new properties."

On Nov. 6 came the third annual November AEC announcement—the U.S. would not pick up the Canadian option, but would permit the Canadians to stretch out their deliveries until 1966 and will honor any contracts purchased from other Canadian companies.

The announcement specifically states that deliveries to Eldorado of production transfers are to continue at a rate no greater than the purchasers' original contract—the purchaser cannot hike his mine output; he can only extend the life of his operation. Prices paid will be the price in the contract acquired. To encourage the stretch-out, Eldorado (and the U.S. AEC) will advance to the company $2.50 per lb for every pound deferred from the delivery schedule. The U.K. AEA has agreed to pay $1.50 per lb for deferred deliveries on its contracts into the period Jan. 1, 1965 to Nov. 30, 1966. Concentrate specifications under the stretch-out will be different than for the original contracts.

Mr. Pearson ripped into the Canadian government saying "the responsibility for this sorry failure is divided between the U.S., concerned only with its domestic producers, and the Canadian government, unable or unwilling to bring the necessary political pressure on Washington at the highest level."

The Toronto GLOBE & MAIL of Nov. 9 said that the U.S. was under no obligation to buy more uranium than it needed and applauded the Canadian government for arranging the stretch-out with the U.S. and U.K. There can be no denying the severity of the U.S.'s action to Canada's export volume—one-third of her income ($275-million) comes from uranium sales. The GLOBE & MAIL urged Canada to sell her uranium on the world market, to compete with Australia, the Union of South Africa, the Congo and the U.S.

"Canada's uranium producers deserve a more favorable treatment . . . in the years before the contracts expire, it should be possible to work out a joint U.S.-Canadian program to safeguard producers of both countries", added the MILWAUKEE JOURNAL in an editorial, Nov. 18, 1959.

Speaking at the Future of the North, 12th British Columbia Natural Resources Conference, Dr. John Davis, director of research and planning for B.C. Electric Co. Ltd., stressed the need for a gaseous diffusion plant program as a way out for Canada, and added that the Peace River in B.C. would be just the place for it—another Kitimat or Arvida. However, S. W. Clarkson, of AEC, writing in PRECAMBRIAN, November 1959, said that the question of Canada's building a gaseous diffusion plant (minimum cost, $500-million) would neither be justified nor would it help the uranium industry materially.

One interesting sidelight has been that Canadian mine unions have withdrawn their contract demands temporarily and are taking a second look in the light of certain job reductions.

During the year, Rayrock Mines had closed with two-thirds of its contract unfulfilled. Stanleigh, Stanrock, Can-Met and Canadian Dyno ran into difficulties of one kind or another. Lorado has very little ore, with two-thirds of the contract unfulfilled. Any Canadian mine may sell its contract to another producer.

Pronto, the Algoms, Bicroft, and Gunnar got contract extensions from the U.S. AEC. Gunnar's price was $8.75 per lb. Gunnar's operating costs are reported to be $2.70 per lb. Also, Gunnar will sell U_3O_8 to Rayrock.

Eldorado entered the bidding for the above contracts, much to the distress of the private mining companies, for Eldorado is the crown corporation set up during World War II to operate the appropriated Gilbert LaBine discovery. The private companies find themselves bidding against the government. The NORTHERN MINER sug-

gests that Eldorado stay out of the bidding and that a contract in a camp (Elliot, Bancroft, or Beaverlodge) only be sold to another producer in the same camp.

According to Robert Winters, president of Rio Tinto of Canada (before the Electric Club of Toronto, Dec. 9, 1959) the stretch-out will take some time to arrange and will involve a reduction in operations of 40 to 50% with a corresponding reduction in employment. Also, the companies are faced with heavy commitments in housing and social benefit, and the "chore of reducing employment after just having worked so hard at getting into full production and employment" —for 1959 was a good production year in Canada, too. Production hit what is certain to be a peak of 14-million tons of ore hoisted and 15,600 tons of contained uranium produced. It will be some time before production reaches these levels again in Canada. 1960 will be a difficult year north of the border for uranium miners.

The Union of South Africa, whose uranium sales to the Combined Development Agency added $145-million to the national economy, formed a research agency with the mines participating to 50% of the costs (see outlook below) and of late there have been reports that the mines with contracts ending prior to 1966 will consider a stretch-out of deliveries. Ellaton has sold its contract to Africander Lease.

Uranium Ore Production Estimates

Country	1959* (Short tons per year)	1960** (Short tons per year)
United States	6,900,000	7,200,000[1]
Canada	14,000,000	See note No. 2
Union of South Africa	24,600,000	See note No. 3
Australia	650,000	650,000[4]
The French Community	620,000	1,000,000[5]
Belgian Congo	435,000	435,000[6]
Northern Rhodesia	21,116	See note No. 7
Japan	160[8]	
India	unknown[9]	
Portugal	unknown[9]	
Sweden	unknown[9]	
West Germany	none[10]	
Spain	none	60,000[10]
Italy	none[10]	
Argentina	none[10]	

* All 1959 estimates are official government response to E&MJ questionnaire, except Australia and the Belgian Congo.

** All 1960 estimates are the authors, based upon the qualifications noted below.

[1] U.S. actual production to Oct. 31, 1959 was 5,632,000 tons, 0.25% U_3O_8. Our 1960 estimate is based upon the closing of Monticello and the operation of all 24 mills at average of 22,404 tpd ore feed.

[2] Canadian actual production to Oct. 31 1959 was 11,669,852 tons, graded 2.23 lb recovered U_3O_8. Until the complete details of the Canadian stretch-out are in, there can be no usable estimate of 1960 ore production.

[3] Union of South Africa actual production to Oct. 31, 1959 was 20,512,360 tons, graded 0.524 lb recovered U_3O_8. There is a distinct possibility that a stretch-out is in the works for some Union mines. No usable estimate of production can be made until these decisions are made.

[4] Australian figures for 1959 and 1960 are not official, but based on last year's Australian AEC forecasts.

[5] The French Community reports Metropolitan production rate in the month of October at 73,510 short tons. The estimate of 1960 production is based on the addition of a 1600-tpd mill in September 1959 and of a 720-tpd mill in mid 1960. Any estimate of French ore grade is difficult due to the wide range of grades from the various mines.

[6] Belgian Congo 1959 and 1960 figures are unofficial and based on the Union Miniere du Haut Katanga annual report for 1958. Congo ore grade is about 0.3% U.

[7] Northern Rhodesia entered the lists possibly for the last time unless new uranium deposits are discovered. Rhokana Corp. mined the last ton of uranium-bearing ore in July. In August, the mill closed after milling the last of the 27,161 tons of ore on hand, graded 0.162% U_3O_8.

[8] Japan became a producer of ore and concentrate and will soon make metal.

[9] India's ore production is difficult to gage since almost all to-date comes from beach-sand mining of thorium-containing ores. In 1960 there will be some Indian ore production (excess of 200,000 tons). Portugal's figures are not known. Sweden's uranium is gained from the processing of some of the residue of an oil-shale refinery and no tonnage figure is stated. However, after 1964, Sweden will be mining oil-shale for uranium extraction at Billingen at the rate of 24,000 tpy.

[10] West Germany will be a producer in 1960 as will Spain, Italy and Argentina. West Germany will produce 16 tons, 75% U_3O_8 in 1960. Spain will have one 200-tpd mill onstream in 1960.

Spain's uranium resources are estimated at 1,500 tons of metal (see E&MJ July, 1959, p 148), but an important discovery has been made in the province of Avila. The uranium mill at Andujar—Spain's first—is onstream and is expected to treat 200 tpd in 1960. A similar plant is planned for Salamanca Zamora and a third (and larger) one for Caceres Badajez.

In Metropolitan France a 1,600-tpd mill at Bessines went onstream in September and another of 720 tpd capacity is to be completed in Forez by mid-year, 1960.

Italy will be into metal production by mid-1961 at 160 tpy; 350 tpy by the end of 1962 (also see E&MJ April 1959, p 198).

Finland reports that a deposit discovered by Atomienergia Oy will be mined near Eno (100,000 tons, 0.2% U_3O_8).

Argentina reports some 200,000 tons, 0.1% U_3O_8 have been discovered in Salta province. A processing plant is scheduled for Salta (see E&MJ September 1959, p 182).

Sweden will open the Billingen oil shale deposit at 120-tpy metal output by 1964. Present production is coming from residues of an oil-shale refinery at Kvarntorp. The large oil-shale deposits at Narke and Vastergotland are considered to be too low-grade to be mined for uranium alone, being only 0.02% U_3O_8.

Japan's official agency — Atomic Fuel Corp.—reports that one important discovery has been made in the Massif regions now being systematically examined. The deposit at Ningyotoge (Ningyo Pass) is a low-grade conglomerate containing at least 1.5-million tons, 0.05% U_3O_8.

India reports the uranium plant onstream (see E&MJ April 1959, p 130). At Ghatsila, the pilot program to recover uranium from copper tailings is still under way. The richest ore yet discovered in India is that of Umra, near Udaipur, ore grading 0.5% U_3O_8. An upgrader is being erected at Bhunas mine in Bhilwara to yield 1- to 3% concentrates. At Jaduguda in Bihar, some 1.84-million tons, 0.06% U_3O_8 has been proven to a depth of 1,000 ft. Production will be 500 tpd. Keruadungri prospect in Bihar has nearly 1.1-million tons, 1.5-million tons, 0.05% U_3O_8.

The outlook for a commercial uranium market is gloomy, if viewed only from the recent past. During the year, Euratom reduced its 1965 installed nuclear power goal from a very optimistic 15,000 megawatts (MW) to the 4,000 MW shown on p 123 February 1959 E&MJ. That figure may well have been trimmed even further since only one Euratom nation has picked up its World Bank loan for the construction of a reactor—the Italian firm Senn will build a 150-MW General Electric designed reactor.

The reason—coal, oil and gas. The Continent has the greatest glut of oil,

Uranium Concentrate Production Estimates

Country	1959*	1960** (Short tons of contained U_3O_8)
United States	16,330	17,000[1]
Canada	15,600	See note No. 2
Union of South Africa	6,200	See note No. 3
Australia	980	980[4]
The French Community Metropolitan France	850	1,700[5]
Madagascar	101	101[5]
Belgian Congo	1,800	850[6]
Northern Rhodesia	38	See note No. 7
Sweden	10	10[8]
Japaa	30kg	1,100kg[9]
India	unknown[10]	
Portugal	unknown[11]	
West Germany	none	16[12]

* All 1959 estimates are the result of conversion to "contained U_3O_8" of the official government responses to E&MJ questionaire, except Australia, India and the Belgian Congo. All data are in tons except Japan's (kilograms).

** All 1960 estimates are based upon the qualifications below.

[1] U.S. actual production of uranium contain in concentrates to Oct. 31, 1959 was 13,562 tons contained U_3O_8. U.S. concentrates average about 80% U_3O_8. The 1960 estimate is based upon the closing of Monticello and the operating of all 24 mills at an average of 22,404 tpd ore feed. All U.S. domestic contracts have been or are being extended to Dec. 31, 1966 (except Kerr-McGee's).

[2] Canadian actual production of U_3O_8 contained in concentrates to Oct. 31, 1959 was 13,050 tons U_3O_8. Grade is not available. No 1960 estimate of production can be made until all the details of the stretch-out are settled. U.S. has announced that it will not pick up the Canadian option, but will permit stretch-outs to 1966.

[3] Union of South Africa actual production of oxide in concentrates grading 88% U_3O_8 to Oct. 31, 1959 was 5,372 tons. All contracts with Combined Development Agency (U.S. and U.K.) expire by 1966.

[4] Both the 1959 and 1960 estimates are not official.

[5] The French Community reports Metropolitan France's October production at 135 short tons grading 73.1% U_3O_8 and an estimated 1,320 short tons, grading 70.8% U_3O_8 for all 1959, hence the estimate of 850 tons contained U_3O_8. The 1960 estimate is based upon an average daily ore treatment of 4,200 tons—double that of 1959. Madagascar produced 57 tons in October grading 17.8% U_3O_8 and 58.4% Th, and estimated 1959 total production at 627 short tons, grading 17.7% U_3O_8, hence the estimate of 101 tons contained tons U_3O_8. Production on Madagascar will remain essentially the same in 1960.

[6] Belgian Congo figures are unofficial and based upon the 1958 annual report of Union Miniere. Shinkolobue mined 435,704 tons, milled 326,361 tons, produced 3,136 tons concentrate (68.5% U_3O_8) in 1958.

[7] All available ore at the Rhokana Corp. mine in Northern Rhodesia was mined out in July. The mill closed in August after producing 76,567 lb of uranium-bearing concentrate of unknown grade. The 1959 figure is an estimate of tons of concentrate (not contained U_3O_8).

[8] Sweden produced about 10 tons of contained U_3O_8 from the residue of oil-shale refining. Mill and refinery will be onstream by 1964 to turn out 120 tons of uranium (U) a year from shale.

[9] Japan produced 30 kg of uranium (U) in 1959 on the 3-tpd pilot plant and will continue its operation through 1960.

[10] India has been producing metal since late in 1958.

[11] Portugal figures were not reported.

[12] West Germany will have a plant onstream in 1960 and turn out about 16 tons of contained U_3O_8.

gas and coal in its history. The situation will probably get worse before it gets better. There are some 34-million tons of coal on surface on the Continent; another 50-million tons in the yards in Great Britain. There have been fantastic oil and gas discoveries in the French Sahara—the French predict 50-million tons of oil out of the Sahara by 1965—more than twice French needs. Libyan fields are even larger. Gas fields in the Sahara will yield the equivalent of 12-million tons of coal by 1965 and the Lacq, France gas fields another 5-million-ton equivalent, according to Omer Andersen in MINING CONGRESS JOURNAL, December 1959. Paradoxically, U.S. coal has a better future on the Continent in the next 10 years than does U.S. uranium.

Not only is Euratom slowing its reactor program—they are not buying uranium at the present time. According to ATOMIC ENERGY NEWSLETTER, Sept. 29, 1959, Euratom will not buy and stockpile U.S. uranium now because they are betting on a substantial price cut after the present round of procurement contracts expire. By that time, Belgium and France will be able to handle all of the Continent's uranium needs (see last year's review, February 1959 E&MJ, p 123).

Despite the seeming reluctance of the European nations to jump into the nuclear stream, Etienne Hirsch, president of Euratom, predicts that by 1980, Europe will have installed nuclear capacity equal to its present total generating capacity of 200-billion kw.

The British picture is obscured by the 50-million ton mountain of coal stockpiled on surface. There are those who say Britain is finding nuclear power too costly and will go no further. (Early in 1959, the Soviet nuclear officials told Adm. Hyman Rickover that Soviet planners had misled the politicians about the cost of nuclear power. The Russians were finding the price too high.) Some observers said that British operating costs were too high. Others claimed that the capital cost would not come down. Still others pointed to the coal pile and said that it would not be used up by the normal expansion of power generation until after 1965.

Correspondence with the British Ministry of Power brought E&MJ the following information:

The fact that the capital cost of building a coal-burner in England has fallen in the past decade is not too important to the generating field, since the part of the operating cost contributed by the capital cost of a coal burner is small compared to the cost of the coal . . . In planning a power station, one is not concerned with a short term position: the power station will be there for decades. It takes four years to build a plant, during which time the immediate fuel situation may change drastically. A great deal of time, effort and money are being spent on nuclear power around the world—the cost is bound to come down. So is the cost of the uranium. "Economic Factors—past and present", by J. A. Jukes, 6th International Exhibition on Electricity & Atomic Energy, Rome, Italy, June 1959. Also see "Commonwealth Links in Nuclear Energy", by Sir William Cook in COMMONWEALTH CALLING, May 1959).

The 5th annual report of the U.K. Atomic Energy Authority (1958-59) says that capital costs of nuclear stations are predicted to fall 30% as the development potential of the present generation of reactors is realized. Further cuts are predicted through development of the newest reactor types.

Speaking before the House of Lords July 15, while he was Minister of Power, Lord Mills said:

"I was urged to consider the question of delaying the nuclear power program. I am sorry to hear that raised again . . . We still lead the world in nuclear power . . . There is a steady flow of nuclear power work being done, which is essential to the existence of our nuclear power industry and any revising would be prejudicial to the development of that industry . . . I believe that in certain countries it may be a long time off before they can get cheaper power from nuclear energy that they can produce from their indigenous fuel. I

think that is true in America, but it is not true in this country."

The British have not given up—there has been no recent alteration in the British nuclear power program which still aims at 5,000 MW by 1966. They are currently building Berkeley (Gloucestershire), 275 MW; Bradwell (Essex), 300 MW; Hinkley Point (Somerset), 500 MW; Trawsfynydd (North Wales), 500 MW. The Central Electricity Generating Board has consent to build Dungeness (Kent), 500 MW; and is awaiting consent to build Sizewell (Suffolk), 650 MW; and Oldbury-on-Severn (Gloucestershire) 1,000 MW. Sites have been investigated on the Isle of Wight, on the South Coast, Anglesea and on the Severn estuary. The South of Scotland Electricity Board is building a station at Hunterston of 320 MW.

One additional point should be made—British coal investment planning at present would yield only 240-million tons of coal in 1965—coal could provide only one-third of the rise in energy requirements in Britain between now and 1965 ("More Energy For British Industry," by S. E. Schattmann, JOURNAL OF MINES, METALS & FUELS (India), September 1959).

At home there was a similar slow down as in Europe. Only one new U.S. reactor was started in 1959. According to the WALL STREET JOURNAL, the current lull in the U.S. is due to the reluctance of the utilities to dig any deeper until they see some concrete results from reactors now under construction. Caution has entered in—the outlook for economic operating costs in the present round of U.S. reactors is not good. In a recent engineering and design study (POWER REACTOR TECHNOLOGY, September 1959) the PWR, BWR, OCR and HWR concepts were compared on paper to coal-burners of the same size. Not one had an operating cost lower than the coal-burner. Furthermore, none of the four showed any sizable advantage over the other. The coal-burner's costs were estimated in the 6.9-to 7.4-mill/kwh range while the nuclear reactors power costs fell in the 8.3-to 11.8-mill/kwh range.

There were other market setbacks in 1959. The AEC cut down sharply on its estimate of the savings to U.S. industry through the use of isotopes and radioactivity from the 1957 appraisal of $400-million to a mere $40-million—one-tenth of the 1957 figure.

The U.S. Army cancelled its food irradiation program, saying that irradiation killed vitamins as well as bacteria and that test animals fed irradiated food showed undesirable abnormalities and defects in offspring.

The Athabasca oils and nuclear shot was cancelled and may never be revived if the Geneva nuclear ban is arranged.

According to Jesse Johnson, director of raw materials, U.S. AEC, fiscal 1959, U_3O_8 purchases will be about 33,000 tons, which is in balance with present requirements. For fiscal 1960, purchases will be an estimated 35,915 tons; in fiscal 1961 around 36,000 tons. From 1962 on, U.S. purchases will be much less than requirements (see E&MJ, May 1959, p 22).

The outlook for uranium is good if one takes the long look ahead based on these 1959 accomplishments:

Domestic miners and millers have a guaranteed market until 1966 for the most part. Canadian producers have firm contracts into the 1962-63 period and with the option of stretching out their deliveries to the end of 1966. There is talk of the same among the South African producers. Contracts with Australia expire in 1966 (except Rum Jungle, end of 1962). In almost all of the contracts, the pricing was such that the plants will be amortized by the time the contracts expire. In Canada, the stretch-out and cut-off may be a way out for mines having financial difficulties. These mines may be able to give their bond-holders a better chance to break even by selling their contracts to healthier mines.

Production costs are coming down. In the U.S. contracts are in force for as low as $7 per lb according to the Uranium Institute vice president Gordon A. Weller. In Canada, the stronger mines are driving the cost way down—Gunnar is at $2.70 per lb; Eldorado is at $4; the giant Cons. Denison is near that figure; even little Pronto Uranium Mines Ltd., one of the finest managed mines in all Canada, is down to $4.75 per lb; and the two Algom properties average just under $5, according to the NORTHERN MINER. In the Union of South Africa operating costs range from $2.49 per lb to a high of $10.54 (see E&MJ, September 1959, p 18).

One bright spot has been the LFBR concept in which a critical reaction is controlled by water which regulates the distance between uranium oxide pellets much as the gas-particle action within a FluoSolids reactor. A test has been contracted for, but it will be about 18 months before results are available. The method could reduce both operating costs and capital costs by eliminating the costly rodding operation.

Five nuclear submarines were launched in the U.S. in 1959—the U.S. Navy is the uranium industry's best customer. The *N.S. Savannah* was launched (it will not be economic) and the USSR's icebreaker *Lenin* started on her maiden voyage in September. Westinghouse Electric offered package deals for nuclear reactors guaranteeing 7.4 mill power when onstream (it takes about four years to build a reactor). The Dresden, Ill. reactor—the world's largest to-date—went critical Oct. 15, 1959.

Direct conversion of nuclear energy to electricity was achieved at Los Alamos for the first time when 3.5v were generated for a period of twelve hours by thermionic conversion of a nuclear reaction in a cesium vapor. Direct conversion is at least 20 years away, but it would drastically reduce power costs by eliminating the steam plant end of a power station.

Another important development was the radioactive tracing of deoxyribonucleic acid (DNA) through the chromosome structure of living cells, enabling the geneticist to study genetic building blocks. For the importance of this discovery, see George W. Beadle's essay in SCIENCE & RESOURCES, published by John Hopkins Press, 1959, 250pp. Price $5.)

An additional bright spot was the formation in the Union of South Africa of the Atomic Research Fund with a $2.2-million bank roll (half of which will be supplied by the gold-uranium industry). Joining with the miners to develop uses of uranium and implement a reactor development program in the Union are the Electricity Supply Commission and the Iron & Steel Industrial Corp., according to SOUTH AFRICA TODAY, June 30, 1959.

Yet another bright spot was reported by Sir John Cockroft in an address at the opening of the Tehran Nuclear Center, June 22, 1959—"We have also been developing the application of really massive sources of radiation and by that I mean sources of radiocobalt having a radiation intensity equal to 100,000 grams of radium. The first commercial application is to be sterilization of *Bacillus anthracis* in goat hair . . . the first plant of this kind is being built in Australia. . ."

The U.S. has three stations totalling 72 MW in operation and 11 in construction with a capacity of 957 MW, and two plants with a capacity of 400 MW in the planning stage. An optimistic estimate has been made that by 1980—two decades from now—there will be about 250 nuclear plants in operation (each of 200 MW size or better), consuming 10,000 tons of natural uranium a year in the U.S. alone. END

Zinc

Charles R. Ince
St. Joseph Lead Co.

DESPITE the harmful impact of the steel strike, the increased consumption of zinc in other industries and the restriction on imports due to the imposition of quotas resulted in an improved zinc market in 1959. The average price for the metal at 11.-448c was over one cent higher than the previous year's average of 10.-309c, and smelter stocks, (See Table I) were 45,000 tons below the start of the period. It would not be unreasonable to say that if it had not been for the 116-day steel strike which adversely affected the use of zinc for galvanizing and, late in the year, zinc for die casting in assemblies requiring steel, the use of the metal might have surpassed the tonnage established in any peacetime period. As it was, consumption exceeded the previous year by nearly 11%, reversing a three-year cycle of steady declines from the peak of 1955.

Abroad, the situation also showed continued improvement. The increase in consumption outside the U.S., coupled with the curtailment in production or exports of foreign producers agreed to at the United Nations Lead-Zinc meeting in New York in April, led to a steadily improving market which rose from around £76 on the London Metal Exchange to £96 at the end of the year. As a matter of fact, with the higher rate of usage outside the U.S. and the improvement in the domestic economy, it became apparent at the end of the year that a continued curtailment in production of zinc abroad might be unnecessary and there were indications that at the United Nations meeting scheduled for Geneva the latter part of January, 1960, the curtailments agreed to the previous April would be rescinded.

U. S. Slab Zinc Production & Stocks

	1959 production	Stock at 12/31/58	Stock at 12/31/59
Special High Grade	335,499	52,921	12,512
High Grade	61,413	9,236	4,442
Intermediate	13,741	3,874	1,928
Prime Western, etc.	447,367	124,206	135,537
Total	858,020	190,237	154,419

The discouraging aspect of the zinc picture in 1959 was the continued low rate of domestic mine production which showed only a slight increase above the previous year's level which, it may be recalled, was the lowest in 25 years. The 412,000 tons produced was still far short of the Administration's "adequate mobilization base" of 550,000 tons. While some of the lack of improvement in mine output could be attributed to strikes that affected both New York State and Montana production, it is hardly likely that the figure would have gone above 450,-000 tons, indicating that quotas or some form of import protection was still necessary to raise mine production to the mobilization base. Although improved conditions abroad might warrant some removal of restrictions on supply, a relaxation on U.S. imports does not appear appropriate at this time. Whatever improvement has taken place in the domestic picture has been due chiefly to an increase in consumption which has permitted some liquidation of the smelters' excessive stocks. As can be seen from the "balance sheet" in Table II, the deficit of 85,000 tons in 1959 was roughly equivalent to the improvement in consumption of 94,000 tons.

The trend in consumption throughout the year followed the Federal Reserve Board Index of Durable Manufactures, to which the usage of zinc is closely aligned. Starting the year at 80,000 tons a month when the FRB figure was 153, it rose with the Index throughout the first half and hit a peak of 96,000 tons in June when durable goods manufactures also registered its high for the year of 172. During the third quarter, as the Index declined to 156, the consumption dropped to 62,600 tons in September. In the fourth quarter, with the settlement of the steel strike, both the FRB figure and zinc consumption started to rise and ended the year at an accelerated pace which promised to carry well into the new year, 1960.

The improvement in usage of the metal was general throughout the zinc-consuming industries with the exception of the steel industry (see Table III), and even here despite the nearly four months strike, the decline was only a moderate one of 4%. Nevertheless, it enabled the die casting industry to again take first place as the largest zinc consumer. The 1.3-million increase in car production by the automotive industry, which accounts for 60% of total die casting applications, enabled the industry to register a 20% gain over the previous year.

With industry forecasts of 6.5- to 7.0-million car production and renewed use of die-cast grilles and other heavy applications, it can be expected that die casting may very well regain the high production level attained in 1955, their peak year. A preliminary weight data survey of 1960 models made by the staff of the American Zinc Institute indicates that of the 19 leading cars only two will have less zinc on them and the balance will have increases running as high as 30 lb per unit. While the weight per unit has not been determined yet for 1959, the average usage of zinc in

Table I Total Slab Zinc Smelter Output

(All grades—short tons)

1959	Stock beginning	Production	Shipments: Domestic	Shipments: Export & drawback	Shipments: Gov't. acct.	Shipments: Total	Stock at end
Jan.	190,237	76,481	70,770	171	—	70,941	195,777
Feb.	195,777	71,174	65,641	849	—	66,490	200,461
Mar.	200,461	79,918	73,814	482	—	74,296	206,083
April	206,083	76,393	78,358	255	—	78,613	203,863
May	203,863	77,489	85,073	275	—	85,348	196,004
June	196,004	75,544	99,858	204	2,100	102,162	169,386
July	169,386	73,101	59,460	94	900	60,454	182,033
August	182,033	69,768	58,918	864	—	59,782	192,019
Sept.	192,019	62,202	57,971	3,214	—	61,185	193,036
Oct.	193,036	63,938	63,910	1,813	—	65,723	191,251
Nov.	191,251	62,346	74,596	2,844	—	77,440	176,157
Dec.	176,157	69,666	84,498	6,906	—	91,404	154,419
Year to date		858,020	872,867	17,971	3,000	893,838	
Monthly avg.		71,501	72,739	1,498	250	74,487	

previous years has run as high as 73 lb per car.

Despite the fact that the use of zinc for galvanizing was relegated to second place due to the steel strike, it promises to regain its dominant position this year through the expansion of continuous galvanizing lines. The unique properties of the type of coating produced by this process which permits the coated metal to undergo the most rigorous forming operations such as stamping, drawing and extruding without cracking the zinc layer, continues to open up applications for the galvanized product which were not considered possible a few years ago. One of the latest of these is the use of galvanized sheet in the under-structure of automobiles to protect that portion of the car from the corrosive effects of mud, water and the chemicals used to melt snow and ice on the roads. Both the Falcon and Corvair have adopted this method of protection and others will probably follow. For this application a method of wiping one side of the sheet practically clear of zinc has been devised for ease in welding the sheet to the frame. If the motor car industry generally should follow this trend, the market for the sheet would be expanded enormously, not to mention those applications in which a galvanized sheet could be used due to the elimination of the weldability problem. Evidence of the growth potential in this industry is the fact that as of December 1959 there were 35 continuous lines in operation with six under construction and two in the planning stage, compared to 22 in 1954.

Brass mills, the third most important use of zinc, had a relatively bright year throughout most of 1959 despite the strikes which plagued the copper mining and smelting industries. Their consumption of zinc rose 35%. The biggest improvement appears to have taken place in sheet and strip and can be accounted for by the pickup in durable goods manufacures. Brass rod still suffered, as did some other brass products from the inroads of lower priced imports. It has been estimated that some 16,000 tons of domestic zinc consumption was lost due to the zinc content of imported brass items.

Rolling mills, which account for a little less than 5% of the total zinc consumed, showed only a moderate increase in consumption compared to the average of 11%. Dry cell battery cans continue to be the main outlet for strip while engravers plates and hull plates for cathodic protection accounted for the major part of the sheet production. While a great deal of interest was stimulated by the announcement of one company of a "wonder" T metal containing titanium, it is still too early to assess its possibilities. In its approach the American Zinc Institute, through its Industry Development Committee, has instituted studies to develop what potential market, if any, exists in the use of zinc sheets for roofing, as is done in Belgium and France.

Zinc oxides accounted for about 100,000 tons of zinc in ore, 20,000 tons in metal and close to the same tonnage of zinc in secondary materials. Total shipments of lead-free zinc oxide to domestic consumers in 1959 are estimated to have been about 180,000 tons, an increase of about 16% over 1958. The rubber industry, which consumes about 54% of the total zinc oxide, largely accounted for this. Total domestic rubber consumption increased about 14% to 1.6-million long tons, which is an all-time record. Total tire sales increased 6% to 88-million units, reflecting the continuing increase in production of replacement tires and recaps. The paint industry, which normally consumes about 22% of the total zinc oxide, also enjoyed an excellent year. 1959, however, saw domestic primary zinc oxide producers continue to be seriously affected by competition from imported zinc oxides.

Many of the oxides are excellent quality French Process types being offered at as much as 3c per lb below the market. Imports of zinc oxide increased from 11,700 tons in 1958 to an estimated 16,000 tons in 1959, an increase of more than 35%. The Zinc Pigments Committee of the American Zinc Institute has continued its efforts to find ways to increase the usage of zinc oxide. Through cooperative efforts of the staffs of the member companies, the story of the value of zinc oxide in paints has been brought home to the paint industry. 1960 is expected to be an excellent year for zinc oxide consumption with both the paint and rubber industries expected to exceed 1959 consumption.

The main concern of the U.S. zinc oxide industry as the year ended, was the possibility of further increases in the imports of foreign material. The "loophole" in the quota system which omitted any restriction on manufactured items, while curtailing the raw material imports, encourages foreign producers of zinc metal and ore to convert into oxide. A Tariff Commission review of the lead-zinc quota system in January has provided the opportunity to rectify this manufactured product loophole.

The forecasts of economists, both business and Government, as well as those of many laymen, point to 1960 as being a year of exceptionally high industrial activity. With the increase in consumption and continued restraint on imports of metal and concentrates through quotas providing further liquidations of producers' stocks, it appears almost inevitable that all phases of the domestic zinc industry may look forward to their most prosperous year since 1955. END

Table II Zinc Balance Sheet

	1959	1960 estimated
Consumption	962,000	1,100,000 +11.5%
Supply		
Mine production*	412,000	500,000
Secondary	70,000	70,000
Concentrate Imports* (including fume from Mexico)	362,000	362,000
Metal imports	133,000	140,000
	977,000	1,072,000
Deduct zinc content ores and secondaries used in American process oxide.	−100,000	−100,000
	877,000	972,000
Deficit	85,000	128,000

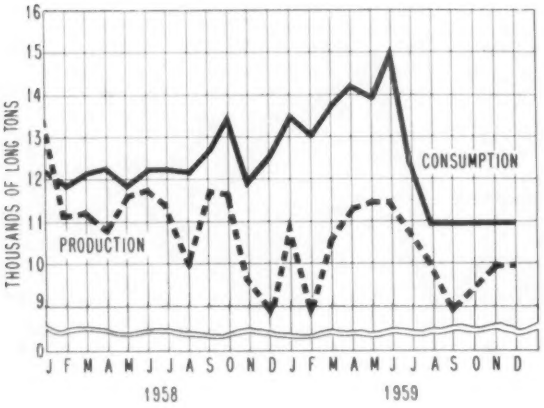
*Recoverable metal content.

Table III Consumption by Industries

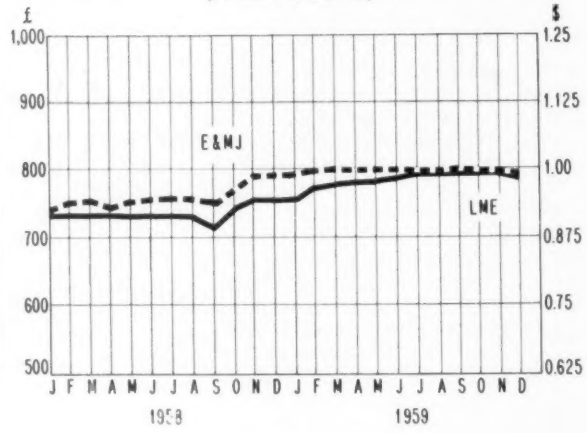
	1958	1959*	Percent change from 1958
Galvanizing:			
Pipe, wire, etc.	187,000	179,000	− 4
Sheet & strip	194,000	187,000	− 4
	381,000	366,000	− 4
Brass & bronze	101,000	136,000	+35
Zinc-base alloys	317,000	380,000	+20
Rolling mills	41,000	43,000	+ 5
Oxide	13,000	19,000	+ 5
All other uses	15,000	18,000	+20
	868,000	962,000	+11

*Last two months estimated.

World Tin Production and Use
(Thousands of long tons)



E&MJ and London Tin Prices
(Pounds and Dollars)



Tin

J. R. O'Connell, Jr.
Engineering & Mining Journal

THE 1959 MARKET was decidedly quieter than turbulent 1958. The calm has been accompanied by relative stability and a world-wide respect for the ability of the International Tin Council to perform under pressure. Nineteen-Sixty presents far fewer uncertainties and an optimism which was missing 12 months ago.

The International Tin Agreement was battered, and the market vulnerable when 1958 ended. The U.S. recession, heavy Russian exports (18,000 tons), severe export quotas and a shortage of cash in the hands of the Buffer Pool manager were responsible for the poor situation in tin as the year began.

The tension eased early in January when Russia and the ITC finally agreed upon an export figure for 1959. The Russian Bloc (China included) would be permitted to ship 13,500 tons of tin to European markets, approximately 4,500 tons less than 1958 exports. With a definite figure on paper, the ITC was able to look ahead.

Export quotas of 48% were carried over from the final quarter of 1958 through the first quarter of 1959. The restriction allowed only 20,000 tons of metal per quarter to be exported by producing countries.

End-of-year statistics for 1958 showed a reversal of 1957. In the latter year, output had exceeded consumption by 16,000 tons. World stocks were estimated at 410,000 tons. In 1958, world consumption was 14,000 tons greater than production, dropping stocks to about 396,000 tons. The past year (1959), as was generally predicted, will probably show a spread of about 25,000 tons between consumption and production. An early estimate sets world mine output at 125,000 tons and world consumption at 150,000. The difference was made up by sales from the ITA Buffer Pool and metal purchased in 1958 by the Pool manager with an undisclosed Special Fund.

Market strength in the first half pushed New York prices above $1.04 per lb in February and enabled the highest monthly E&MJ average of the year, $1.043, to be recorded in June. U.S. demand in anticipation of the steel strike was sharp. The lowest price of the year was 98c on Jan. 2. Prices had dipped to about 99c in December as the steel strike lingered. The 1959 New York yearly average was $1.021 per lb, the highest level since 1952 and a gain of exactly 7c over the previous year.

With the Russian threat erased, buyers here focused on the widely-advertised steel strike. The market firmed almost immediately as platers bought heavily. Extreme quotas in the first quarter limited supply. With arrival of the London Metal Exchange quotation at £780 late in February, the Pool manager began liquidation of stocks purchased with the Special Fund. The job took two days, with an estimated 4,500 tons of metal passing from the Pool to consumers.

With this supply dissolved, the manager dug into a Buffer Stock that had reached 23,325 tons by the end of 1958. Steady selling balanced the market throughout the first half.

Producing countries, restrained by quotas, were partially pacified with barter. Through September, the U.S. Department of Agriculture's Commodity Credit Corp. took 6,450 tons of metal in exchange for U.S. surplus agricultural products. Tin was taken from producer surpluses and exempted from export restriction.

The first meeting of the ITC was held in London Feb. 17-19. Total permissible exports were raised 3,000 tons to 23,000 tons for the second quarter.

In May, quotas were again eased. The ITC, meeting in Copenhagen May 26-29, announced that third quarter exports had been increased 2,000 tons to 25,000 tons. The market had reached a stage where ITA members agreed to handle sales of 2,500 tons of metal from the strategic stockpile of the British Board of Trade. Sales began July 1 and were completed by the end of the year. Shortly afterward, the British indicated they would release an additional 2,500 tons—the balance of their stockpile—commencing Jan. 1, 1960.

Steady Pool selling in May stabilized the market. U.S. tinplaters operated at peak preparing for the soon-to-materialize steel strike. Delayed arrivals of metal in New York tightened the spot supply, and prices moved past the $1.04 mark. By late June plater buying had dwindled.

With the strike on in July, plater activity (considered to be about 50% of U.S. consumption) all but ceased. Previous buying had left them well

supplied for the summer. They expected to cover for the fourth quarter at lower prices. Excess spot material eased prices here, but steady markets in London and Singapore prevented any real price slump. A contango remained in the New York market for most of the summer. Imported tinplate in fair quantities prevented a supply squeeze on can companies and helped maintain a healthy London market. It also eliminated a buying surge by U.S. platers upon termination of the steel strike in January 1960.

A post-vacation pickup by nonplaters, spurred by threat of a dock strike, sparked the market slightly in late August. A Taft-Hartley injunction ended the strike after eight days.

Despite lack of U.S. buying, the ITC (London, Sept. 1-3) for the third successive time eased quotas. Allowable exports were raised 5,000 tons to 30,000 tons. Consumption was running ahead of production, and Russia, who in 1958 had swamped the market, had thus far shipped a negligible amount. The Buffer Stock had been cut to 13,990 tons by June 30, ITC reported.

With end of the steel strike widely predicted, observers, who first considered further-liberalized quotas bearish, turned to a bullish view. They felt normal consumption would again tighten the quota-fixed market. The strike lingered, however, and the Presidential injunction did little to stimulate business in the U.S. Platers feared a second walk-out in late January, but still the market remained steady. Higher Pool asking prices buoyed the market and suggested further reduction in the Buffer Stock.

In a move labeled bearish, the ITC, meeting in London Dec. 1-4, for the fourth time in 1959 eased quotas. Exports were moved up an unexpected 6,000 tons (20%) to 36,000 tons for the first quarter of 1960. The promise of a ready supply of metal figured to give U.S. platers time to sit back and watch the market until certain of a steel settlement.

The ITC action suggested that the Buffer Stock, despite some occasional buying, had been cut to perhaps 9,000 or 10,000 tons. More generous export privileges figured to balance production with normal first quarter consumption. The guess that the U.S. steel strike would soon be settled was a correct one. The move largely eliminated any chance of an upward price movement at the end of the strike.

The new year finds ITA in complete control of the world market.

Primary Tin Statistics

(Long tons)

	1959	1958
World mine output.....(c)	**125,000**	134,000
World consumption.....(c)	**151,000**	148,000
World stocks: Gov'ts included.....(a)	**370,000**	396,000
(d) Gov'ts excluded.....(b)	**70,000**	94,400
U. S. consumption	**42,000**	48,000
U. S. import (pig).	**42,000**	56,158
U. S. output (pig) at Texas smelter	**8,000**	5,440
Price, av., N. Y. prompt.....	**102.053c**	95.125c
Price, av., London, cash.....	**£785.210**	£735.035

(a) This estimate was arrived at by adding to the International Tin Study Group figure for the end of 1947 of 135,000 tons, the excess output over consumption each year. (b) I.T.S.G. figure (c) Excludes USSR, includes Red China. (d) Includes Buffer stock (U.K.)

In the past year the organization has upped export quotas from 20,000 tons per quarter (80,000 tpy) to 36,000 tons (144,000 tpy), estimated at 95% of known ability to produce. She has liquidated an estimated 4,500 tons of Special Fund stock and cut the Buffer Stock from 23,000 tons to somewhere between 8,000 and 10,000 tons. She has dispersed 2,500 tons of British stockpile metal and is in the process of disposing of a final 2,500 tons. She has seen the U.S. Government remove 6,450 tons of non-exportable metal to the stockpile through barter. She was able to maintain prices throughout the extended steel strike.

The current year may not be the boom year many are predicting, but it bids to be at least average-to-good. World consumers appear ready to take the output of ITA producing members. Some observers believe first quarter production may be too much for consumption, but should an imbalance occur, the Pool stands ready to buy up and stock the surplus.

Russian exports to non-Soviet Bloc markets in 1959 were small enough to be ignored. Possibly they were 2,000 tons. Her activity in 1958 appears to have been a one-shot move. Many observers feel Russia needs all her output for herself and the Satellites; that she has become a net importer of tin. All estimates indicate Red Chinese production outstrips consumption by 15,000 tons, but figures vary widely, particularly guesses on Russian Bloc needs.

Russian exports to London and the Continent are expected to be slight in 1960. They are being discounted as a market influence.

Tinplate output in early 1960 is not expected to keep pace with steel production. Because of the influx of European plate, buyers were never really pressed during the strike. Steel companies in the U.S. were considered to have fair stocks of tin as the year began. One buyer of tin in New York, believing that the steel companies prefer to keep a substantial supply on hand, looks for improved buying late in the first quarter—at about the time producing countries are ready with increased tonnages.

A narrow price range of between 99c and $1 per lb is predicted for the first half. The market promises to be relatively uneventful with a lack of price fluctuation. There is little chance that the Pool would let the market decline, but the chance of aggravating U.S. consumers—who to some degree resent the controlled market—with higher prices is also unlikely. The U.S., with a vast store of excess tin, far beyond stockpile requirements, is a stern deterrent to inflated prices. Should consumption exceed estimates, and Russia remain out, the U.S. may offer some metal for sale. Such action would probably coincide with removal of remaining ITA export restrictions—a likelihood for the second or third quarter. World output has been upped sharply, however. Market progress will guide ITA which in turn will key U.S. action. Were quotas removed, the Government may adjudge she is entitled to a small portion of the market she helped stabilize for so many years with buying.

ITA's recovery in 1959 was timely in light of United Nations renewal discussions scheduled for June 1960. The Agreement ends officially in July 1961. Prospects for a five-year continuance seem bright now that output has been returned to near normal. That the U.S. will again be requested to join as a consuming member is certain. The ITA stipulation that members announce stockpile disposal plans in advance would be a vital factor in world price control, were the U.S. a member. A clause encouraging prospecting and development may well be added.

The Malayan outlook after one year is vastly improved. Recent elections promise political stability for the next five years.

In 1960, look for prices around 99c, a steady near-balanced market, cancellation of export quotas, renewal of the Tin Agreement and possibly some U.S. stockpile selling. END

MAJOR METALS

Iron Ore and Steel

A. W. Knoerr
Engineering & Mining Journal

PROJECTED CONSUMPTION PATTERNS for the steel industry's best customers automatically provide the basis for the 1960 iron ore outlook. According to American Iron & Steel Institute, these customers have used the following quantities of steel annually during the 1956-57-58 period:

Market	Range in % of domestic shipments
Automotive industry	17.6 to 18.9
Construction and contractors' products	15.0 to 17.5
Containers	8.3 to 11.4
Machinery and industrial equipment including electrical machinery	8.6 to 9.4
Oil and gas, including drilling	6.0 to 8.6
Domestic and commercial equipment	4.5 to 5.8
Rail transportation	2.6 to 5.5
Agriculture	1.5 to 2.1
Shipbuilding, marine, aircraft	1.5 to 1.8

Steel output for the U.S. in millions of net tons was reported by AI&SI as 112.7 for 1957, 85.3 for 1958, and 93.4 for 1959. The chart shows production for the past five years, as well as estimated production for 1960, which varies from 128-million to 140-million net tons, depending upon which estimates one uses. Industry forecasters quoted in this review last February estimated that the steel output for 1959 would total about 110-million tons if strikes and inventory cutbacks did not materialize during the second half. During 1958 and 1959, steel consumers have used up about 34-million tons of inventory—the largest and most prolonged inventory decumulation on record. This is expected to contribute to making 1960 one of the best on record for steel production.

Charts and graphs showing trends in industries that will have strong impact on steel consumption, and accordingly on iron ore production, are shown on p 119. These include auto and truck production, farm and other types of machinery manufacture, railroad equipment, shipbuilding, and foods and beverages which are directly related to container manufacture. W. C. Stolk, president of American Can Co., predicts a record year for the packaging industry. McGraw-Hill Department of Economics estimates that food sales will be up nearly 5% in 1960, and beverage sales up 7%.

Construction estimates and statistics reported by CONSTRUCTION DAILY, ENGINEERING NEWS RECORD, and CONSTRUCTION METHODS AND EQUIPMENT are as follows:

Estimated construction put in place

(Billions of dollars)

	New	Repairs	Total
1958	49.1	19.0	68.1
1959, unofficial	54.0	20.5	74.5
1960, forecast	56.0	22.0	78.0

Given an adequate supply of iron ore and concentrates, and a year unimpaired by strikes, the steel industry is in a good position to supply any reasonable demands that consumers may place upon it. Steelmaking capacity in the U.S. increased from 147.6-million tons annually Jan. 1, 1959, to 148.6-million tons, Jan. 1, 1960.

Iron ore producers, and steel companies which supply all or part of their own raw materials, are pushing their long-range expansion plans without abatement. The compilation of projects planned, completed or underway, pp 92-96, indicates the current status of these plans.

Distribution of Iron Ore in the World[1]

Billions of metric tons

	High Grade 50% +Fe	Lower Grade 25 to 50% Fe
Western Hemisphere		
U. S.	0.986	20.416
Canada	2.006	3.256
Brazil	11.968	—
Cuba	—	5.544
Others	0.748	0.528
Other Free World		
France	—	6.688
India	11.968	—
So. Rhodesia	—	24.904
Sweden	1.496	—
Union So. Africa	—	5.104
Others	1.972	3.862
Sino-Soviet Bloc		
USSR	2.108	15.928
China	0.748	1.760
Total	34.000	88.000

[1] Based on chart in "The Battle for Steel Supremacy," by Alexander Gakner, U. S. Bureau of Mines, Division of Foreign Activities, in IRON AND STEEL ENGINEER, November, 1959. Article points out that if other types of iron-bearing reserves are included, the USGS estimates U. S. resources to be 75-billion tons; and Soviet reports indicate that their reserves will total about 115-billion tons.

In a management report to employes (THE HANNA MINER, December 1959) R. W. Whitney, general manager of ore mines, M. A. Hanna Co., appraised future sources of iron ore in part as follows:

"Prior to 1956, only negligible quantities of concentrates or pellets were produced in the Lake Superior region. Now eight plants have an annual capacity of more than 15-million tons of concentrates from taconite and jasper in the same area. Total output of concentrates should increase from approximately 10-million tons in 1958 to nearly 15-million tons in 1960.

"Total tonnage of iron produced in the U.S. is expected to remain approximately constant during the next 15 years. In the Lake Superior district underground ore production should remain the same, but declining open-pit production of ore as now produced will decline and have to be offset by taconite and jasper concentrate production.

"Foreign ores will be required increasingly to supply U. S. needs. Canada, for instance, which can currently export 17- to 20-million tons of ore annually to the U. S. and Europe, should be capable of exporting 34-million tons a year by 1965."

In South America, Mr. Whitney said, all known major deposits on the east and west coast are being carefully studied. Exports of iron ore from South America are currently in the 20-million-tons-a-year range, and the potential is double or even triple that amount.

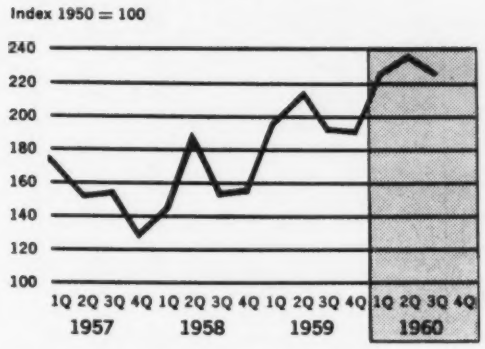
In West Africa, most current activity is centered in Liberia, which can now export about 3-million tons a year. By 1962, this could exceed 13-million tons.

Mr. Whitney concluded that the Lake Superior District will remain the nation's most important single source of iron ore for many years. But to do so, industry will have to resort to more and more beneficiation of ores, employ more men to mine and process the ore, and make further progress in mining and processing technology. In a climate of world-wide competition, he said "Companies, employees, labor unions and governmental bodies must unite to increase efficiency, obtain greater productivity and reduce costs."

Issues debated by labor and management in the most publicized of

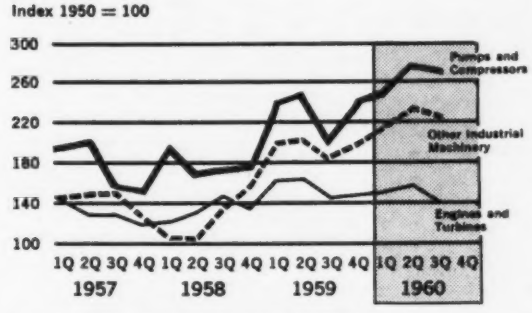
(*Continued on p 144*)

NEW ORDERS FOR CONSTRUCTION AND MINING MACHINERY



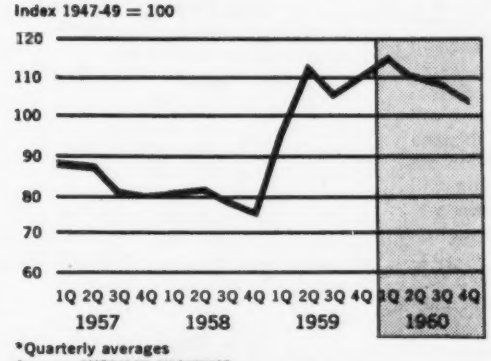
Source: McGraw-Hill Department of Economics

NEW ORDERS FOR OTHER MACHINERY GROUPS



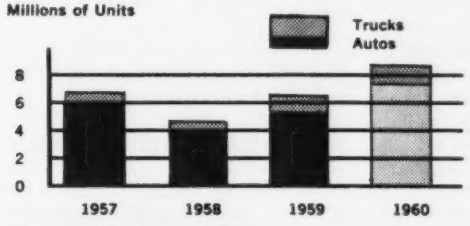
Source: McGraw-Hill Department of Economics

FARM MACHINERY PRODUCTION*



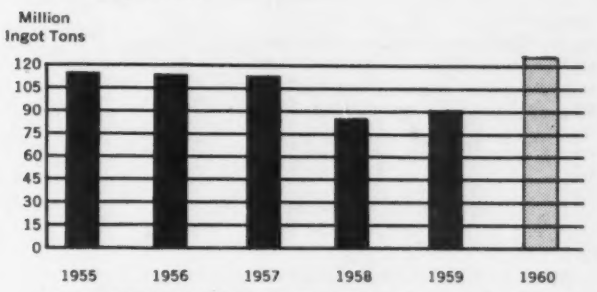
*Quarterly averages
Source: AMERICAN MACHINIST; McGraw-Hill Department of Economics

AUTOS AND TRUCKS, U.S. FACTORY PRODUCTION



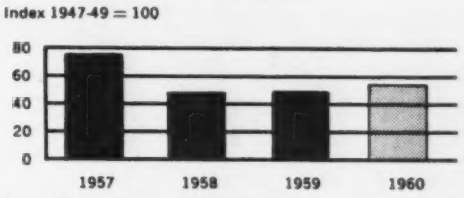
Source: Ward's Automotive Reports; McGraw-Hill Department of Economics

STEEL PRODUCTION



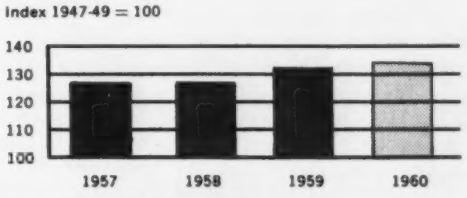
Source: AMERICAN IRON & STEEL INSTITUTE; McGraw-Hill Department of Economics

RAILROAD EQUIPMENT PRODUCTION



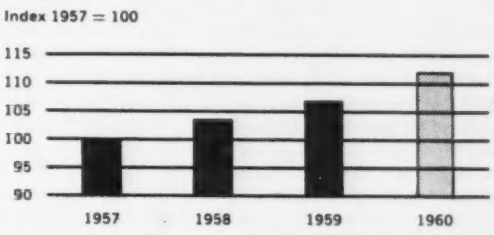
Source: Federal Reserve Board; McGraw-Hill Department of Economics

SHIPBUILDING



Source: Federal Reserve Board; McGraw-Hill Department of Economics

FOOD AND BEVERAGES PRODUCTION



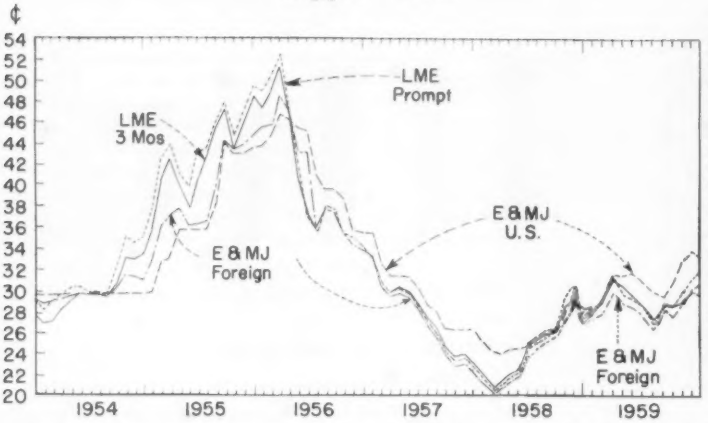
Source: McGraw-Hill Department of Economics

Near-Record Expenditures Planned

Iron and steel companies in the U.S. expect to spend $1.6-billion for new equipment and construction during 1960, according to American Iron & Steel Institute.

The outlay will be $640-million larger than 1959 expenditures, and only $150-million below the all-time record $1.75-billion spent during 1957. If the 1960 outlay comes up to expectations, the total spent for postwar expansion during the years 1946 through 1960 will amount to about $13.6-billion. This illustrates the maxim that, "It takes steel to make steel." The iron and steel industry is one of its own best customers.

Copper Prices



Monthly averages. E&MJ prices are weighted average prices per lb computed from actual reports made to E&MJ by copper selling firms. These may be from 140,000 to 200,000 tons a month. They are reduced to f.o.b. U.S. refinery Atlantic seaboard. The London Metal Exchange prices are the average of the bid and asked and refer to long tons. The two scales, cents per pound and £ sterling per long ton, are equal at an exchange rate of $2.80 per £. At this rate £320 per long ton is equal to 40¢ a pound of metal, etc. Data through December 1959.

Copper

George H. Cleaver
Engineering & Mining Journal

COPPER CONSUMPTION and production in 1960 are likely to be considerably higher than in 1959 and may be at a record level.

This will doubtless be accompanied by high incomes for the copper mining and smelting firms. But high copper production may cut prices in the last half of the year and higher cost producers may find net income dropping to a rather low rate.

Fabricators in the U.S. and elsewhere will have a good year. Though copper and brass product imports into the U.S. will continue to get attention, they are not likely to increase nearly so much as imports of aluminum and other products.

Victories and defeats in the continuing battle with competing materials produce changes in the consumption and production of copper, but year to year changes are mainly determined by the movement of economic conditions. The writer's belief that 1960 will be a good copper year is based on the expectation that the economy will operate at a considerably higher rate than it did in 1959. Owing partly to the steel strike, a considerable amount of consumer and producer hard goods demand has been backed up. Consumer and business income in 1959, and expectations for 1960, have been good and allow for possible increases in buying. Inventories of many products will need to be built up and for many others inventories are not excessively high. Government expenditures show no sign of dropping off and should give some push to the economy—though some predictions of a Government surplus of income over outgo cause some caution on this point. Expectations that the Federal Reserve will boost interest rates and thus dampen economic expansion are based on the notion that economic expansion will be excessive and highly inflationary; such interest rate increases depend on the view that the economy is or soon will be operating at a very high rate and would not occur unless the condition suggested here (a high rate of economic activity) actually developed.

Pricing and marketing policy by copper firms changed very little in 1959 and important changes are not likely in 1960. Further moves toward integration of production and fabrication were apparent, but these were not sufficient to have a significance for pricing. They may have been enough to increase somewhat the amount of copper which is first marketed when it becomes a semi-fabricated product. Movement of refiners into mining may be more significant.

Much U.S. custom smelter copper was sold at flat prices. Some was also sold on contracts covering many months that specified the E&MJ domestic price, usually the monthly average, for whatever amount was taken during the month. Foreign sales

Copper Statistics (a)

(Thousands of short tons)

U. S.	1960 forecast	1959	1958
Output			
Mine	1,000	802	1,008
Secondary (b)	475	447	411
Refined	1,600	1,222	1,447
Imports (c)			
Ore, etc	125	88	93
Blister	325	275	268
Refined	140	208	128
Net imports (ore, blister, refined) (c)	350	382	94
Net imports, scrap (g)	−55	−29	−38
Net imports (semi mfg.) (c)	80	63	51
Exports, refined (c)	230	160	385
Stocks, ref., sellers	110	65	81
Del. to fabricators	1,475	1,312	1,179
Del. by fabricators (d)	1,425	1,400	1,165
Fabricator stocks (end of year) (d)	445	395	447
Apparent consumption (e)	1,360	1,176	1,157
Actual consumption (f)	1,540	1,445	1,251
World			
Mine output	2,950	2,860	2,713
Refined output	3,100	2,927	2,811
Refined del. to fabricators	3,050	2,973	2,918
Stocks, ref., producer	343	293	263
Prices, per lb., in cents			
E&MJ, U. S., f.o.b.	31.000	31.182	25.764
E&MJ, foreign, f.o.b.	28.000	28.892	24.123
E&MJ, foreign, c.i.f.	28.945	29.837	—

(a) Unless otherwise indicated, based on Copper Institute data. An estimated 400,000 tons of Free World copper (all outside the U.S.) is not reported to C.I. An estimated 500,000 tons produced outside the Free World is also excluded.

(b) From old scrap, alloyed, unalloyed, and other, based on Bureau of Mines data.

(c) American Bureau of Metal Statistics. Based on U.S. Census Bureau data.

(d) Based on Copper Association data. Stocks include refined metal, metal in process, metal in products and in inventory.

(e) From U.S. Bureau of Mines. New refined copper withdrawn from year's total supply on domestic account.

(f) From Bureau of Mines; actual reports from foundries and fabricators.

(g) American Bureau of Metal Statistics based on U.S. Census Bureau data. Shown as negative —the figure measures the extent to which exports exceed imports.

(h) The 1960 forecasts are by the author. In some cases the last month or two of 1959 was estimated.

U.S. Copper and Brass Mill Shipments

(Millions of lb, gross weight)

	Sheet	Wire	Rod	Pipe Tube	Total
Copper					
1956	223	9	88	418	737
1957	190	6	67	381	644
1958	146	5	51	416	618
1959	**183**	**7**	**63**	**488**	**742**
Brass and Other Alloys					
1956	526	88	489	158	1,261
1957	471	78	391	142	1,082
1958	401	73	329	117	920
1959	**512**	**97**	**433**	**122**	**1,163**

Data from American Bureau of Metal Statistics. Excludes production by wire and cable mills.

U.S. Brass and Bronze Ingot Shipments

(Short tons, gross weight)*

1957	261,400	1954	277,100
1958	227,607	1955	314,100
1959	**274,562**	1956	288,500

American Bureau of Metal Statistics data based on statistics from Defense Council, Brass and Bronze Industry.

*About 75–80% is copper.

were made at whatever price obtained in the particular foreign market.

Merchants in the U.S. sold heavily in the strike period late in 1959. Most of their copper was sold at flat prices.

Most primary copper sold in Europe is still priced on the London Metal Exchange. Unsuccessful discussions were held in Europe between producers and fabricators in connection with changing the pricing basis. Most of the contracts provide that the LME cash settlement price is to be used. Many contracts also provide that if an LME wire bar quotation is instituted it will apply rather than the standard copper quotation. In some cases the buyer, by advising the seller before 11 am, can have his copper priced on the previous day's quotation ("buying on the known"). Most of the Chilean copper, it appears, is sold on contracts that contain a clause prohibiting resale except by express consent of the seller. The contracts also have "out" clauses. These provide that if the buyer or seller becomes dissatisfied with the pricing basis, after a notice of a few months he can cancel the contract.

The "out" clauses undoubtedly reflect sellers' displeasure with the LME as a pricing basis for copper. This displeasure was discussed here in detail last year and the conclusions still hold. If an opportunity develops most producers would dump the LME without hesitation.

Strikes against copper mining and refining companies were perhaps the major problem of the copper industries in 1959. The first strike was probably the one against Cerro de Pasco in February; it was settled early in March. Kennecott's Ray Mines division in Arizona was struck by the United Steelworkers. Asarco's Tacoma smelter and refinery was struck in mid-March by the Mine-Mill union. A strike broke out at Anaconda's Butte properties in March. Anaconda's Potrerillos smelter in Chile was on strike for about 15 days in July.

These strikes were merely warming up affairs for the big doings. By the end of August about 75% of U.S. copper mining, smelting and refining had been stopped by strikes. Phelps Dodge's Laurel Hill refinery on Long Island, N.Y., was struck Aug. 1 by the United Steelworkers. In late January 1960 it was still struck (it is reported that in January extensive repair work was being done on the chimney). Its El Paso refinery was struck Aug. 20 by Mine-Mill—it too was still struck in January 1960. The company's mining, milling and smelting facilities at Morenci, Bisbee, and Douglas in Arizona and at Los Angeles were also struck. Only its property at Ajo was not out. Its Laurel Hill refinery had been putting out about 14,000 tpm and the El Paso refinery about 22,000 tpm. The firm's mine output was cut about 17,000 tpm.

Kennecott's Western Mining division was struck by Mine-Mill Aug. 10; USW struck it the same day. KCC's Garfield refinery in Utah had been turning out about 17,000 tons per month and its Chino fire refinery about 6,500 tpm. Its mine output had been about 33,000 tpm. It was struck in Chile for almost all of October.

Anaconda's Montana and Tooele, Utah properties were struck, mainly by Mine-Mill, on Aug. 19. It lost about 7,000 tpm. The company's refinery at Raritan, N.J., was not struck —it refined mainly copper from Chile.

Asarco's properties were struck by Mine-Mill Aug. 20. Its three refineries went out—at Baltimore, Perth Amboy and Tacoma. Its smelters at Hayden, El Paso and Tacoma were struck.

Magma Copper Company mines at San Manuel and Superior, Arizona, were struck by Mine-Mill Aug. 11.

One major company settled—American Metal Climax, as in past years, settled without a strike at its refinery at Carteret, N.J. Mine-Mill got 7c per hour wage increase July 1, 1959 and another 7c a year later. Fringe benefits calculated at 7.6c also went to the workers at Carteret. A new pension plan included the provision that they get immediately in a lump sum all they had contributed to the fund—the new pension system is not contributed to by the members. Except for this feature, the AMC settlement without a strike, as in the past, was not much different from the settlement reached in many of the strikes.

These copper strikes were probably the longest the industry ever had. Some were not settled when this was written late in January 1960. Kennecott reached agreement with USW late in November—the price was 22.3c per hr. Asarco settled with Mine-Mill at all its properties in December for about 22.4c per hr. San Manuel also settled. Kennecott and Mine-Mill came to terms late in December, but owing to some disagreement with several craft unions its largest source of copper in the U.S., the Bingham mine, remained out at this writing. Owing to failure to get materials its Utah smelter was cut out in mid-January (it had operated on material left when the strike began) and it was expected the refinery would be out by the end of the month. (Its new refinery in Maryland started shipping wire bars converted from cathodes for some fabricating plants probably in October.)

Integrated copper companies showed one of the good reasons for being integrated. Their fabricating divisions with one exception were not struck and continued to operate (they are not merely to assure outlets for raw metal). Consumers of brass and wire mill products continued to get shipments. Some producers bought copper in good amounts from various sellers. Most of the primary bought was imported copper and a good part of this came from merchant firms. But "captive" brass mills, like others, operate normally with much scrap and the proportion may have increased during the strike. Probably most of the pur-

Copper Mine Capacity*

(Thousand of short tons, annual rate)

United States

	Company or mine		Capacity change	Capacity
1959				1,195
1960	Kennecott: Ray		10	1,217
	Duval: Esperanza		6	
		Ore Knob	1	
1961	Kennecott: Ray		10	1,227
1962	Inspiration: Christmas		10	1,237
1963	Inspiration: Christmas		8	1,245
	Asarco: Mission		45	1,290

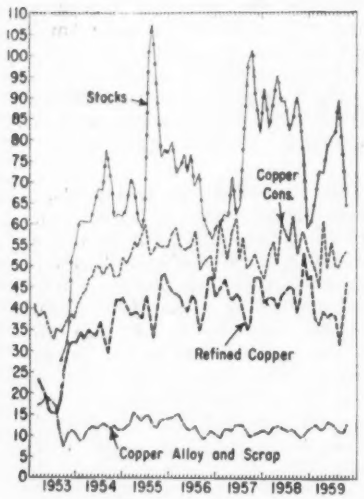
Outside U. S.

1959				2,479
1960	Canada:	Opemiska	11	
		Copper Rand	8	
		Chisel Lake	6	
		N. Coldstream	6	
		Others	4	
	Rhodesia:	Bancroft	34	
		Mangula	4	
	Belgian Congo:	Katanga	20	
	Chile:	El Salvador	60	
		Mantos Blancos	7	
	Peru:	S. Peru Copper	140	
	Haiti:	Halliwell	8	
	Australia:	Mt. Isa	4	
	Philippines:	Atlas	3	
	Ireland:	Irish Copper	6	
			321	2,800
1961	Canada:	Copper Rand	2	
		Atlantic Coast	4	
		Depletions	−13	
	Rhodesia:	Messina	3	
	Belgian Congo:	Katanga	35	
	Chile:	Mantos Blancos	11	
	Haiti:	Halliwell	4	
	Yugoslavia:	Majdenpek	12	
			58	2,858
1962	Rhodesia:	Mufulira	58	
	Uganda:	Kilembe	9	
	Chile:	Penarroya	14	
		El Salvador	−20	
	Peru:	S. Peru Copper	−20	
	Yugoslavia:	Majdenpek	13	
	Cyprus:	Cyprus Mines	7	
			61	2,919
1963	Rhodesia:	Chibuluma	3	
	Chile:	Rio Blanco	24	
	Cyprus:	Cyprus Mines	3	
			30	2,949

World Totals

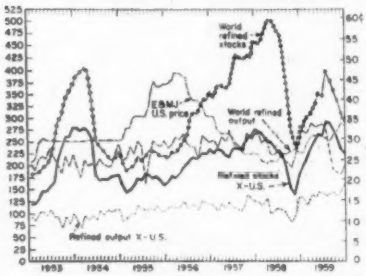
1959	3,679
1960	4,017
1961	4,085
1962	4,156
1963	4,239

U.K. Copper Fabricating



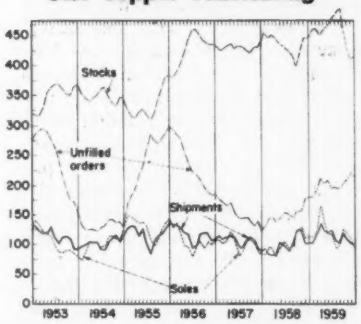
Data in thousands of long tons from British Bureau of Nonferrous Metal Statistics. All series except stocks refer to copper content of fabricated products. "Refined copper" and "copper alloy and scrap" are two month moving averages. "Copper cons." is the sum of the two, adjusted for seasonal variations. Stocks include refined copper held by consumers, blister copper and copper in London Metal Exchange warehouses. Data through October 1959.

Copper Output and Stocks



Copper Institute data, except price, in thousands of short tons. Excludes USSR and other countries outside the Free World. Also excluded are Japan, Scandinavian countries, Australia, Yugoslavia and Messina mine in Africa. The two series "X-U.S." are the world series less the U.S. No fabricator stocks are included. Data through December, 1959.

U.S. Copper Fabricating



From U.S. Copper Association in thousands of short tons. Sales and shipments refer to copper content of products made from purchased refined copper, including copper refined by custom smelters from their intake of scrap and concentrates. Data refer to brass mills, wire mills, and foundries. All series are for fabricated products except stocks which also include copper in process and copper in products in inventory. Sales and shipments are two months moving averages. Data through December 1959.

chased copper was in the wire bar form and used in captive wire mills.

Though most copper companies are too complex to permit accurate predictions of the extent to which some operations will cover others, some notions on this will come out with the Phelps Dodge fourth quarter data. One may say: "Phelps Dodge became an independent fabricator in the fourth quarter." In the second quarter it earned $1.38 per share after depletion; in the third it was $0.49. It, unlike Kennecott which is less integrated, made money in the fourth. Since the company was struck in the middle of the third quarter one cannot assume the difference is an accurate measure of the strike effect. There are other, perhaps more important, reasons for this. In the fourth quarter P-D may have had to buy all its copper on the market while it may have had enough to stock to make this unnecessary in the third. In the third it may have had much copper moving through its fabricating plants and a heavy inventory of copper products ready for sale—sales of these in the third might produce a high profit margin; their absence or reduction in the fourth quarter would have the opposite effect.

Kennecott probably uses only about a third of its production—it lost 12c a share in the fourth quarter. In the second it made $2.27 and in the first $2.03. P-D made 18c in the 4th.

The U.S. Government brought suit to prevent Kennecott from acquiring Okonite, a wire and cable manufacturer.

Great concern about imports of fabricated copper and brass products was again expressed, vigorously, by U.S. fabricators. Imports of copper and brass products rose from about 67,104 short tons, copper content, in 1958 to about 79,000 in 1959 (last month estimated). The accompanying table indicates that net imports of copper in semi-fabricated products including wire and cable reached about 4% of total copper consumption in the U.S. in 1958. In 1959 it was about 4.33%. The data are based on the reports of imports and exports published by the American Bureau of Metal Statistics; the ABMS data were taken from U.S. Census Bureau figures. Exports (not imports) of wire are gross weight; information from wire companies indicate that about half of this is probably copper and the wire component of the export figure was reduced by this amount.

The data do confirm the view that net imports of semi's have increased.

	Imports	Exports	Net imports	Consumption	% cons.
1950	16	29	−13	1,424	− .9
1951	14	18	− 4	1,417	− .3
1952	24	21	3	1,418	.2
1953	19	19	0	1,494	0
1954	22	13	9	1,255	.7
1955	36	19	17	1,502	1.1
1956	46	23	23	1,521	1.5
1957	48	25	23	1,352	1.7
1958	67	16	51	1,251	4.1
1959	79	17	62	1,445	4.3

Data are in thousands of short tons. Consumption is total consumption of copper, calculated by the U.S. Bureau of Mines. "% cons." is net imports of semi-fabricated products as a percentage of total U.S. consumption. Where the negative is shown, exports exceeded imports. Imports and exports are of semi-fabricated products, copper content.

The increase reflects the higher price charged by U.S. manufacturers. Nearly all international trade, like other trade, is based on a price difference. If prices were equal and were expected to remain equal for products the buyers felt were of identical quality there would be no trade. In most cases, including for metal products, labor and material costs are lower outside the U.S. and capital (interest rates) and possibly "real" engineering and technical costs are lower in the U.S. It is not possible to measure the relative costs of all these items (except perhaps by the relative prices of the products). Neither can the Tariff Commission determine tariffs that would equalize costs. The equalization of costs through tariffs would eliminate trade in items made by both trading regions; this can be done by introducing very high tariffs —whether they "equalized" or not would not matter. If such a policy were carried out for all products, possibly 75% of world trade would be eliminated (U.S. exports of merchandise in 1958 were valued at $16,227,000,000 and its imports of merchandise were valued at $12,946,000,000). Such proposals are not taken seriously because all know that countries would be using resources to produce products which they could get much more cheaply through trade. National income for most countries would drop. But some analysts feel that if all proposals for individual industries were added up it would amount to the same thing.

The U.S. was a net exporter of copper again for a period. It did not

(Continued on p 170)

Minor Metals

William R. Barton
Commodity Specialist
U.S. Bureau of Mines

Columbium-tantalum concentrate output by domestic producers in 1959 was half that of 1958. Cb metal production doubled last year's figure. p 126

H. Austin Tucker
Commodity Specialist
U.S. Bureau of Mines

High-purity silicon production and consumption repeated its annual doubling of the previous figure. The tunnel diode threatens a decline in consumption. p 127

J. P. Ryan
Commodity Specialist
U.S. Bureau of Mines

Platinum metals prices rose in 1959 in response to improved demand and a tightened supply. Canada and South Africa are expected to increase their output in 1960. p 135

Arnold M. Lansche
Commodity Specialist
U.S. Bureau of Mines

Cadmium demand led supply through much of 1959, and may well do the same in 1960. Nickel-cadmium and silver-cadmium battery research was continued during the year. p 125

H. M. Callaway
Commodity Specialist
U.S. Bureau of Mines

Antimony consumption rose, based upon withdrawals from inventories. p 124
Bismuth stocks were reduced by increased consumption and curtailed imports. p 132

Peter Colefax
President
American Potash & Chemical Corp.

Boron, with another leap in production last year, proved its position in industry, despite some deglamorization of its role in HEF. p 132

D. P. Eigo
Managing Editor
Engineering & Mining Journal

Titanium metal mill product shipments rose in 1959 as the market base broadened in non military use and the alloy outlook improved. p 133

Albert E. Schreck
Commodity Specialist
U.S. Bureau of Mines

Lithium battled back against problems of excess capacity and termination of AEC contracts with market expansion plans and new products development. p 129

James Paone
Commodity Specialist
U.S. Bureau of Mines

Thorium consumption continued to rise in 1959, principally in alloys used in aircraft and missiles. AEC has begun a new thermal breeder reactor program. p 129

F. W. Wessel
Commodity Specialist
U.S. Bureau of Mines

Zirconium metal found its best demand in the Navy's atomic submarine program; civilian consumption was limited. The Zirconium Association was formed. p 131

Frank L. Fisher
Commodity Specialist
U.S. Bureau of Mines

Germanium found unprecedented use in transistors, although quantity per unit was reduced. p 126
Selenium bases optimism for 1960 on search into selenides. p 128

Donald E. Eilertsen
Commodity Specialist
U.S. Bureau of Mines

Beryl consumption hit a new high with an estimated total of 6,200 short tons. Research was stepped up in the areas of structural use by the armed services. p 124

MINOR METALS

Antimony

H. M. Callaway
U.S. Bureau of Mines

A RISE in industrial consumption, a drop in smelter output, and attendant withdrawals from inventories characterized antimony in 1959. Despite labor strikes in portions of the producing and consuming industries, demand was stronger than in 1958, and supply was adequate within the existing price structure.

According to preliminary figures, consumption of primary antimony during the year rose 10%. Lagging the general increase in industrial activity, antimony consumption during the early months of the year kept the slow pace of 1958. During the second quarter of the year, however, consumption increased sharply, and a boom period was briefly anticipated. Labor strikes, starting in midsummer, quickly erased earlier optimism. Consumption returned to the doldrums in the third quarter, but there was evidence of a more sustained upturn in the offing at year end.

Use in battery grids, antifriction bearings, cable sheathings, type metal, and other metallic products accounted for 60% of the antimony consumed in 1959. Nonmetallic uses in flameproofing chemicals, paints, ceramics, glass, rubber, and pyrotechnics represented 40% of the consumed antimony. Use of regulus and commercial oxide increased proportionally to the over-all rise in consumption.

Smelter production in the U.S. dropped about 10% to 7,700 tons of primary antimony—approximately one-third less than the average annual output in the past 10 years. Imported ores were the chief source of smelter feed, but considerable by-product antimony was recovered from lead bullion and other intermediate smelter products. As in past recent years, there was no production from domestic stibnite mines. However, Sunshine Mining Co. recovered 664 tons of cathode antimony from processing tetrahedrite concentrate recovered from ores of the Coeur d'Alene district, Idaho.

Although statistical support is not available, there is reason to believe output of antimonial alloys from scrap metal increased several thousands of tons to total approximately 22,000 in 1959.

Imports during the year rose 13% to total 12,200 tons—a figure roughly comparable to the 1957 quantity. The increase was almost totally attributable to larger receipts of ores and concentrates. As in past years, nearly all the ores and concentrates came from Mexico, Bolivia, and Union of South Africa. Imports of metal and commercial oxide remained at the 1958 level. All the oxide and nearly all the metal came from industrial Europe. The United Kingdom and Yugoslavia contributed most of the metal, and the U.K. and Belgium-Luxembourg were the exporters of practically all the oxide received in 1959. U.S. exports of antimony were in insignificant quantities.

Antimony Statistics

(Short tons)

	1959 estimated	1958
Domestic mine production	664	705
General imports	12,200	10,800
Primary smelter production	7,700	8,600
Consumption of primary antimony	13,100	11,900
Price, cents per lb	29.00	29.00

The price of RMM brand 99.5% antimony, f.o.b. Laredo, Tex., was quoted at 29c per lb throughout the year. The New York equivalent price remained at 31.30c. The last price change was on Feb. 14, 1958, when a drop of 4c per lb was recorded. Foreign metal was quoted over a range from 22 to 26c, duty paid, delivery in New York, the exact price being determined by grade and origin.

Apparent withdrawals from smelter, consumer, and dealer stocks totaled 2,500 tons of metal and commercial oxide. The diminished stocks were the result of the interaction of labor strikes, increased consumption, and deliveries to Government account under barter contracts.

The antimony producing and using industries are responsive to the changes in the level of general industrial activity. All current economic indicators, including those tied specifically to antimonial products, suggest increases in production and consumption in 1960. END

Beryllium

Donald E. Eilertsen
U.S. Bureau of Mines

A NEW HIGH in U.S. beryl consumption was reached in 1959, with an estimated 6,200 short tons of hand-sorted beryl consumed. Most was used by the Beryllium Corp. in its plants at Reading and Hazleton, Pa., and by Brush Beryllium Co. in its plant at Elmore, Ohio. Principal uses for beryllium alloys were in the fields of electronics, electrical equipment, welding, and metallurgy; and for beryllium metal, in the fields of nuclear energy, instrumentation, aircraft, missiles, and space vehicles. Interest also increased for using beryllium oxide in the electronics industry.

A new firm, Consolidated Beryllium, Ltd., was established in the United Kingdom to produce nuclear-grade beryllium metal and beryllium copper master alloy. The firm is equally owned by Beryllium Corp. and Imperial Smelting Corp., Ltd., of London, a wholly-owned subsidiary of Consolidated Zinc Corp., Ltd.

In the U.S., mine shipments of hand-sorted beryl totaled 350 short tons, the lowest since 1948, and almost all was sold to the Government for premium prices as incentive for production. The approximate price of domestic beryl was $510 a ton. About 200 operations in six states produced beryl in 1959 and approximately 85% of the shipments were from South Dakota and Colorado.

Imports of beryl, from a dozen countries, were expected to total 7,500 short tons and averaged about $300

Beryl Statistics

(Short tons)

	1959 estimated	1958
World production	8,500	7,000
U. S. mine shipments	350	463
U. S. imports	7,500	4,599
Total new supply	7,850	5,062
U. S. consumption	6,200	6,002
Average U. S. price per unit BeO (11% BeO)	$47	$47
Average foreign price per unit BeO (10% BeO)	$29	$34

a short ton, the lowest price since 1950. Brazil, Argentina, Mozambique, Belgian Congo, Madagascar, and Union of South Africa were the largest shippers of beryl to the U.S.

Increased research by industry and various agencies of the Government continued to be aimed at finding methods to make ductile beryllium for structural applications, particularly in aircraft for the Armed Forces. The Bureau of Mines continued its stepped-up program on beryllium consisting of searching domestic deposits for adequate and dependable long-range supplies of beryllium ore, developing methods to concentrate beryllium minerals, and develop processes to extract and purify beryllium. Late in the year, the Bureau erected a small experimental flotation plant to determine whether the small quantities of beryl in North Carolina spodumene-bearing pegmatites could be economically recovered. Beryl concentrate obtained from these ore-dressing studies is to be sent to other stations of the Bureau for extensive beryllium-recovery studies.

Through December 1959, 2,491 short tons of hand-sorted beryl cobbed free of waste was purchased by GSA for the Government on its purchase program for domestically produced beryl. This program started in October 1952 and terminates June 30, 1962, or when 4,500 short tons of beryl (not flotation concentrates) has been delivered, whichever occurs first. Beryl continued to be on the OME list of minerals eligible for Federal aid in financing exploration.

The outlook for 1960 is for continuing the trend toward increased usage of beryllium and its alloys and compounds. END

Cadmium

Arnold M. Lansche
U.S. Bureau of Mines

FACTORS of supply and demand in the nation's economy worked to reduce the over-all supply of cadmium in 1959. Strikes and shutdowns in some zinc-lead mines and zinc and cadmium smelter operations curtailed the output of cadmium, as did quotas imposed on imports of zinc ores and concentrates. Production of primary and secondary cadmium metal together totaled about 9-million lb. Even with the additional 1.4-million lb of cadmium metal obtained through general imports, total new supply of 10.4-million lb was not enough to balance demand, measured by apparent consumption, of 11-million lb. Total metal stocks in 1959 reached a peak of 5.9-million lb in the first quarter and then declined rapidly to an estimated 4-million by the end of the year. Metal producers' shipments, including those for internal consumption, increased from the 1959 low of 2.4-million lb recorded for the first quarter to 3-million in the second quarter and then declined to 2.8-million and 2.7-million, respectively, in the third and fourth quarters. About 926,000 lb of cadmium metal and flue dust was exported during the year, 60% more than 1958.

Total supply, consisting of metal production and general imports of metal, was down 3% compared to 1958. Production was off 7%, but general imports of metal increased 38%. Apparent consumption of cadmium metal, as computed by adding production, net imports, and net stock changes at producers, compound manufacturers and distributors, was up 35%. Total stocks of metal declined about 29% for the whole of 1959.

Most of the general imports of cadmium metal arrived in the first six months of 1959. Canada, Mexico, Peru, United Kingdom, Netherlands, Norway, Belgium-Luxembourg, Italy, Japan and the Belgian Congo supplied the metal to the U.S. All of the imported cadmium flue dust came from Mexico. Exports of cadmium metal, alloy, dross, flue dust, residues, and scrap went to Mexico, Chile, Brazil, Sweden, U.K., France, West Germany, Israel, India, Philippine Islands, and to the Union of South Africa.

Barter. In February 1959 the U.S. Department of Agriculture Commodity Credit Corp. ended barter of surplus perishable goods for foreign produced cadmium.

GSA on Aug. 31 announced the proposed sale of cadmium-magnesium scrap from the national stockpile of critical materials. The Congressional Record of Aug. 31 carried a public notice of the proposed disposition of about 4,413 short tons of the scrap pursuant to the Strategic and Critical Materials Stock Piling Act, 53 Stat. 811, as amended, 50 U.S.C. 98b(e). A process for separating the cadmium and magnesium is described in the 1959 USBM R.I. 5476, Recovery of Magnesium and Cadmium from Incendiary Alloys by Vacuum Distillation, by H. S. Caldwell, Jr., and M. J. Spendlove.

Four factors appeared to be at work during the first quarter of 1959 setting the stage for a price change for cadmium metal: (1) The discontinuance of barter for cadmium metal announced in February; (2) the March decline in price of cadmium on the U.K. market, attributed to American competition; (3) increasing stocks of metal in the hands of U.S. cadmium metal producers, compound producers, and distributors; and (4) increased competition from competitive materials. On April 1 the quoted price declined from $1.45 to $1.30 per lb for sticks, bars, and shapes in lots under one ton, and in ton lots the quoted price was $1.20 a lb. From April 1 to Oct. 1, when the quoted price increased to $1.40 a lb. for lots up to one ton, and $1.30 for ton lots, another set of factors appeared to be involved in pressuring the price upward; the general level of business was good, lengthy strikes involving various aspects of cadmium production were begun in July and August, and available stocks of the metal rapidly declined.

Among the established uses for cadmium, electroplating consumed the majority of the commodity; silver-brazing, low-melting-point alloys, chemicals, and pigments used most of the remainder. Newer uses. such as in batteries, control rods in nuclear reactors, and heat and light stabilizers for vinyl plastic claimed increasing quantities of the metal and compounds.

Research. Several metal companies worked on development of the nickel-cadmium and silver-cadmium batteries for use in automobiles, airplanes, and outer-space vehicles. Efforts were made to counteract hydrogen embrittlement of steel, attributed to cadmium electroplating process, by vacuum depositing cadmium on the steel surface, and by modification of the regular electroplating process by applying first a thin layer of cadmium to the steel part, then baking to drive out the hydrogen and continuing the plating process until the desired thickness was obtained. A silver-indium-cadmium alloy for use as control-rod material in the pressurized water nu-

clear reactors was reported as a substitute for hafnium. The alloy, said to be composed of 5% cadmium, 15% indium, and 80% silver, is metallurgically stable under radiation, resistant to corrosion when in direct contact with pressurized high-temperature water, temperature distortion free ductile, a strong neutron absorber, low in cost, and easily fabricated.

Outlook. There are prospects of increased production of cadmium in 1960 with the possibility that consumption will remain in excess of output during the year. END

Columbium-Tantalum

William R. Barton
U.S. Bureau of Mines

DOMESTIC PRODUCTION of Cb-Ta concentrate in 1959 was about half that achieved in the record year of 1958 when approximately 200 tons of columbium-tantalum oxides were contained in ore shipments. Once again, most of the production was euxenite and columbite concentrates produced by Porter Bros. Corporation from its placer mine in Bear Valley, Idaho, and was destined for Government stockpiles. In the case of euxenite, columbium-tantalum oxides were separated by Mallinckrodt Chemical Works prior to stockpiling. Imports of columbium mineral concentrates during the first nine months of 1959 were 2,659,000 lb, compared with 2,144,000 lb during the same period in 1958. Imports of tantalum mineral concentrates during the first nine months of 1959 were 502,000 lb, compared with 921,000 lb during the January-September 1958 period. The sharp decline in tantalite imports was primarily a result of some consumers operating on large ore stocks accumulated during 1958. Increased columbite imports were a reflection of increased demand for columbium products and also of the Government barter program for foreign columbium-tantalum ores.

U.S. production of first-reduction columbium metal more than doubled in 1959, compared with the approximately 30 tons produced in 1958. The principal consumer field continued to be columbium-base alloys for nuclear, aircraft, and space applications. Tantalum production increased about 10% in 1959 compared with 1958. Use of tantalum-base alloys in nozzles of solid fuel rocket motors contributed substantially to the increase. Electronic uses for tantalum also continued to expand at a moderate, but steady rate. Firms producing the metals during the year were: E. I. du Pont de Nemours & Co., Inc., Newport, Del.; Fansteel Metallurgical Corp., North Chicago, Ill., and Muskogee, Okla.; Kawecki Chemical Co., Boyertown, Pa.; Kennametal, Inc., Latrobe, Pa.; National Research Corp., Cambridge, Mass.; Union Carbide Metals Co., Niagara Falls, N. Y.; U.S. Industrial Chemicals Co., Cincinnati, Ohio; and Wah Chang Corp., Albany, Ore. Ferrocolumbium and ferrotantalum-columbium statistics during early 1959 indicated that a moderate increase in rate of consumption could be expected for the entire year in comparison with 1958 totals. Firms reporting commercial production of ferrocolumbium and ferrotantalum-columbium in 1959 were: Molybdenum Corporation of America, Washington, Pa.; Reading Chemical Co., Robsonia, Pa.; Shieldalloy Corp., Newfield, N.J.; Transition Metals and Chemicals, Inc., Wallkill, N.Y.; Union Carbide Metals Co., Niagara Falls, N.Y.; and Vanadium Corporation of America, Cambridge, Ohio.

Prices of columbium concentrates during the year were quoted at a fairly constant level. Columbite containing 65% combined pentoxides and a Cb:Ta ratio of 10:1 increased from $1.05-$1.10 to $1.10-$1.15 per lb of contained pentoxides during the year. Material containing Cb-Ta in an 8½:1 ratio was quoted at approximately $0.95-$1.00 during the entire year. Prices for tantalite were not quoted publicly, but for material containing approximately 60% Ta_2O_5 prices were in the range $3.50-$4.25 per lb of contained tantalum pentoxide.

Metal prices continued to decline as a result of more efficient industry practices. Domestic columbium prices dropped to $36 per lb for roundels from $55 in January. Tantalum powder was generally available at about $40 per lb in quantity. Ferrocolumbium was priced at about $3.45 per lb of contained columbium, and ferrotantalum-columbium at about $3.05. Both prices were slightly lower than a year earlier.

Outlook for the future of both metals continued excellent. Several new columbium or tantalum-base alloys announced during the year exhibited such excellent characteristics that utilization in various research and development programs began almost at once. If expected results are achieved in these applications, a large increase in demand for these alloys will probably be generated rapidly. Among the alloys receiving attention are: 90Ta-10W, 90Cb-10Ti, 99Cb-1Zr, 80Cb-10Ti-10Mo, 79Cb-15W-5Mo-1Zr, and 70Cb-29Ta-1Zr. The electron-beam melting furnaces developed and made by Stauffer-Temescal, Inc., Richmond, Calif., have been of increasing utility in the production of ultra-pure ingots of many alloys and the pure, unalloyed metals. The tremendous improvement in the known potential resources of columbium-tantalum raw materials also has encouraged the increased demands for the metals since previous doubts to availability have now been largely dispelled. END

Germanium

Frank L. Fisher
U.S. Bureau of Mines

USE of germanium transistors, diodes, and rectifiers continued to soar in 1959 as more than an estimated 125-million of the germanium electronic devices were produced. Refinements in processing and practical scrap recovery methods introduced in 1959 sharply reduced the quantity of germanium consumed in the manufacture of each electronic device. Primary domestic production in 1959 was estimated at 45,000 lb (20,000 kg.), a sharp increase over 1958 and a quantity comparable to that consumed.

Two technical developments were announced during the year which are expected to have an important bearinr on germanium's future. These are the highly respected tunnel diode, announced by General Elecric, and the growth of dendritic germanium

single-crystals as thin, uniform, flat, ribbons announced by Westinghouse. This latter innovation is expected to permit continuous automatic production at a reasonably high speed from raw germanium to the finished transistors.

Six domestic and foreign germanium producers formed a Germanium Development Committee in New York during the year to unite their efforts to find new diversified uses and applications for germanium, its alloys, and compounds. New markets are sought for germanium by the producers because the availability of Free World germanium in 1958 and 1959 was considerably in excess of the demand.

Germanium is produced on a commercial scale solely as a by-product of base-metal production. The world market in 1959 was again dominated by Tsumeb Corp. in South West Africa and Union Miniéré du Haut Katanga in the Belgian Congo. U.S. primary production in 1959 was largely sustained by treating germanium-bearing base-metal concentrates from South West Africa. In Italy, Societa Mineraria Metallurgica Pertusola began producing germanium concentrate at its zinc plant in Crotone, Province of Catanzaro, in 1959. The concentrate is refined in Belgium.

Eagle-Picher Co., Miami, Okla., and American Zinc Co. at Fairmont, Ill., were the only companies with facilities for producing germanium from their own domestic sources of supply. Sylvania Electric Products, Inc., produces germanium at Towanda, Pa., from purchased raw material. American Metal Climax, Inc., announced plans in 1959 for construction of a germanium producing plant at Carteret, N.J. The plant will obtain its raw material from South West Africa and also process scrap germanium.

Prices quoted for germanium during 1959 decreased several times and remained unchanged for the remainder of the year after new low prices were announced on June 16, 1959.

Germanium dioxide and single-crystal germanium prices were unchanged during 1959. The dioxide was quoted at 18.5¢ a gram and single-crystal germanium at 60.5¢ a gram in 10,000 gram lots and 68.5¢ a gram in 1,000 gram lots.

Germanium was subject to the pressure of competition from high-purity silicon for use in electronic devices during 1959. It maintained a price advantage over silicon throughout the year and also retained its domination in the entertainment field in the use of diodes and transistors. In contrast, the use of germanium in rectifier manufacture does not show the wide-range performance characteristics of silicon and, therefore, the use of germanium is confined mainly to the chemical and electrochemical industries where high efficiency in rectification of low-voltage, high-amperage current by germanium rectifiers can be most effectively utilized.

U.S. producers of germanium transistors voiced concern in 1959 over the increased imports of Japanese germanium transistors at prices reported to be lower than U.S. production costs. In September 1959, the Electronic Industries Association asked OCDM to investigate growing imports of Japanese transistors and other semiconductor products and determine whether or not they threaten U.S. security. One effect of the imports of Japanese germanium transistors has been a more intensive development of automation by the U.S. manufacturers of transistors. END

Germanium Prices

(Cents per gram)

1,000-gram lots:	
First red	34.5-35*
Intrinsic	35 del
	37*
10,000-gram lots:	
First red	33*
Intrinsic	35 del
	35*

* f.o.b. shipping point

High-Purity Silicon

H. Austin Tucker
U.S. Bureau of Mines

PRODUCTION and consumption in 1959 appear nearly to have doubled that of 1958, a rate of increase maintained since 1956. New producers entered the field, and improved processes for producing high-purity silicon were developed. An estimated $18-million was spent for about 70,000 lb of high-purity silicon, exclusive of solar-cell grade silicon, for use in the fabrication of semi-conductor devices.

The new producers in 1959 were Allegheny Electronic Chemicals Co., near Bradford, Pa.; Trancoa Chemical Corp., Reading, Mass.; and Monsanto Chemical Co., near St. Charles, Mo. Dow Corning, Midland, Mich., is preparing to enter into production. Foote Mineral Co. started operating a semiworks facility in Exton, Pa. late in 1958. The production capacities for the above plants are unknown.

The firms that have been in the high-purity silicon business previous to 1959 are E. I. du Pont de Nemours & Co., Inc.; International Metalloids, Inc.; Merck & Co., Inc.; Sylvania Electric Products, Inc.; Texas Instruments, Inc.; and the Eagle-Picher Co. The total production capacity of their plants is estimated to be 165,000 lb per year of high-purity silicon exclusive of the solar grade.

Although production data are not available, an estimated 80,000 lb of the top three grades of high-purity silicon plus about 20,000 lb of solar grade were produced in 1959, compared to an estimated 55,000 lb in 1958 of the three top grades and the same amount of solar grade.

Consumption of the top three grades of high-purity silicon in 1959 is estimated to be 70,000 lb. and of the solar grade 10,000 lb. From this quantity, about 6-million transistors and 60-million diodes and rectifiers were manufactured by an ever-growing number of device makers.

Grades and prices were generally stable in 1959, remaining at the same level established in the first half of 1958. The table shows nominal grades, qualities, and price ranges of silicon products prevailing in 1959.

Technology. A trend in silicon fabricating techniques which appear-

Silicon Statistics

	Quality			Price range (per pound)	
	Boron level	Resistivity (ohn-cm)			
Grade	(parts per billion)	P-type	N-type	Granular	Rod
1	3	100–1000	25–1000	320-330	355-750
2	6	40–50	15	220	220-245
3	11	25	5	130	155
Solar & infrared	11+	<5	<5	90	—

ed in 1959 is that of combining several electronic functions into one device. One transistor maker is now mass producing such a device to do the work of three regular transistors. It is a medium power, small-signal amplifier and switching transistor. This is a trend that will slow the rate of consumption of high-purity silicon.

Another trend that does not appear to be as well substantiated in fact as the above, is a tendency of device makers to use more of the less expensive, less pure grades of silicon. For example, instead of using the grade 1 material for a certain application, grade 3 would be substituted and the difference in quality would be compensated by improved "doping" procedures and device designs. Such use of the lower grades of silicon has always been possible, since the essential design function of diodes and rectifiers is the amount of reverse voltage that can be tolerated, which condition is not critical in low voltage applications. There is today, however, no substitute for the purest grade of silicon in high-reverse voltage situations. The trends, if real, apparently depends on a more intelligent use of, and a more clever manipulation of the lower grades of high-purity silicon.

A large inventory of transistors, diodes and rectifiers is maintained by device makers. This appears to be the result of a lack of a testing technique that will show precisely what quality of performance will come from each batch of high-purity silicon. Only when the device is completed can it be finally classified—with the result that many devices, perhaps one-third of those made, are not in accord with what had been specified. These "rejects" are placed in inventory until an order arrives which corresponds to their characteristics.

Several firms have developed methods of casting silicon of optical quality which permit volume production of silicon lenses, domes and flats for use in infrared sensors in military weapons systems.

The two most important applications of silicon transistors are in computers and missiles. In demand for use in computers are high-speed and high-frequency switching types, whereas power switching and audio signal types are in most demand for missile applications. The most desired feature for both of these applications is switching performance. Also important in computer use is a low, reverse current characteristic. The two greatest problems encountered in using silicon transistors are reported to be high saturation resistance, particularly in high power applications, and the wide variation of parameters found. One device maker produces a transistor with switching speeds up to 25 millimicroseconds. The minimum breakdown voltage is 20v and the maximum saturation voltage is 0.6-v.

The most important advance in semiconductor devices since the transistor is the tunnel diode, first reported in 1958 by Leo Esaki, a Japanese scientist. It appeared on the market late in 1959. Its switching speed is a fraction of a millimicrosecond, from 10 to 100 times as fast as the fastest transistor. Oscillation frequencies higher than 2,000 megacycles already have been achieved and 10,000 is anticipated. Silicon tunnel diodes have worked at temperatures of 650°F, 250° higher than conventional diodes. It is much smaller than its conventional counterparts. This, together with the trend mentioned before, to combine several electronic functions in one device, would indicate that the amount of high-purity silicon consumed per device will decline. Also more than other devices, the tunnel diode will tend to reduce the consumption of silicon through substitution of materials, because in addition to germanium they can be made of gallium arsenide, gallium antimonide, indium antimonide, and certain other materials. However, much higher purity silicon is used to make rectifiers, a function that has not as yet been duplicated by any device requiring a smaller amount of material than is now used. END

Selenium

Frank L. Fisher
U.S. Bureau of Mines

PRODUCTION and shipments increased during 1959 despite the copper strike which curtailed production during the second half of the year. Producer stocks decreased sharply, imports were normal, and the price remained unchanged.

Commercial-quality selenium was quoted at $7.00 a lb and high purity $9.50 a lb since February 1958. Ultra-high-purity selenium 99.999+%) was quoted at $20.00 a lb. Imports for the first nine months totalled 118,000 lb. Of this quantity 72,300 lb came from Canada, 31,200 from Belgium-Luxembourg, 2,100 from Japan, 835 from Sweden, and 11,700 from the United Kingdom. This does not include selenium-bearing concentrates imported from Mexico and Rhodesia-Nyasaland.

The 1959 production of selenium is estimated at 800,000 lb compared to 727,000 lb in 1958. Producers' shipments are estimated at 850,00 lb, an increase of 13% over 1958 shipments. Stocks of selenium at the producers dropped sharply in 1959 to an estimated 350,000 lb at year end. The drop in volume of stocks reported by producers is attributed to increased demand, the copper strike, and by inventory adjustments.

Companies reporting selenium production and shipments for 1959 were: Allied Chemical Corp., Marcus Hook, Pa.; American Metal Climax, Inc., Carteret, N.J.; American Smelting & Refining Co., Baltimore, Md.; International Smelting & Refining Co., Perth Amboy, N.J.; Kawecki Chemical Co., Boyertown, Pa.; and Kennecott Copper Corp., Garfield, Utah. All primary selenium production in 1959 was as a by-product of the electrolytic refining of copper. Production of secondary selenium in 1959 was estimated at 5% of the primary production.

Selenium Statistics

(In pounds)

	1959 estimated	1958
Production	**800,000**	727,000
Producers shipments	**850,000**	737,000
Producers stocks (Dec. 31)	**350,000**	550,000

The use of selenium as a semiconductor in the manufacture of dry-plate rectifiers was the major consuming outlet in 1959, although sharp competition from high-purity silicon, and to a lesser extent germanium, was in evidence. The consumption of selenium by the metallurgical, rubber, and pigment industries showed a slight increase. Considerable interest in the use of high-purity selenium in other semiconductor devices, especially thermoelectric applications, was noted during the year.

Selenium remained in Group I of the national stockpile List of Critical and Strategic Materials throughout

the year. OCDM included selenium among minerals eligible for Government financial participation up to 50% in OME projects, and the element also was on the Department of Agriculture Barter program.

The future of the selenium industry is looked upon with optimism for the first time in several years. Results of preliminary research on binary and ternary selenides as compound semiconductor materials indicate potential widespread use. Emphasis on selenium processing technology was focused on methods for producing high-purity selenium in 1959, and interest was revived in the commercial extraction of selenium from other sources than as a copper by-product. END

Lithium

Albert E. Schreck
U.S. Bureau of Mines

THE DOMESTIC INDUSTRY in 1959 was characterized by keen competition, concentrated efforts on expanding existing markets, and development of new uses for lithium products. This activity was necessitated by the threefold problem confronting the industry: (1) Excess plant capacity to produce lithium compounds; (2) termination of AEC contracts; and (3) the stockpile of lithium hydroxide (depleted in lithium-6) which will eventually have to be absorbed by commercial markets.

The uncertainty of the immediate future for lithium was evidenced by production cutbacks and other economy moves. Domestic production of both minerals and compounds was at reduced rates. One major foreign ore source, Bikita Minerals, Ltd., of Southern Rhodesia, announced that it was putting its lepidolite operations on a stand-by basis in early 1960.

Lithium Corp. of America, in an effort to reduce costs, was transferring its St. Louis Park, Minn., producing facilities (metal, chloride, hydride, etc.) and its research labs to new quarters adjacent to its Bessemer City, N.C., plant. This move will save the cost of shipping large quantities of lithium hydroxide and carbonate from North Carolina to Minnesota for further processing. Plans also included shifting the home offices from Minneapolis to a point on the east coast, probably in the metropolitan New York City area. LCA also announced that it would re-open its North Carolina spodumene mines in 1960. The firm already had notified Quebec Lithium Corp. that it would accept no further shipments of spodumene concentrates from them. The latter firm claimed the contract was still on force and has won an out-of court settlement.

Other developments in the industry in 1959 included the acquisition of Maywood Chemical Works, the oldest domestic lithium producer, by Stepan Chemical Co.; the installation of a new lithium chloride plant at Henderson, Nev., by American Potash and Chemical Corp.; and the exercise of a five-year option by Texas Gulf Sulphur Co. on the spodumene properties in North Carolina.

Montgary Explorations, Ltd., opened its Bernic Lake, Manitoba, properties to supply amblygonite to Metallgesellschaft, A.G., Frankfurt, Germany. Worldwide marketing of Montgary's mineral products will be conducted by W. R. Grace and Co. and Metallgesellschaft.

No new firms entered the domestic lithium mineral or chemical production picture. Recovery of dilithium sodium phosphate from Searles Lake was continued by American Potash; it was all converted to lithium carbonate at Trona. That firm's subsidiary, American Lithium Chemicals, Inc., continued to process Rhodesian lepidolite to the hydroxide at San Antonio, Tex. Maywood operated the Etta mine in South Dakota for spodumene and produced lithium salts at its New Jersey plant. Foote Mineral Co. produced spodumene concentrate at Kings Mountain, N.C., at a reduced rate from 1958. The material is converted to lithium chemicals at Sunbright, Va. The firm also announced that it was now producing a ceramic-grade spodumene. Lithium Corp. produced lithium chemicals from Canadian spodumene concentrate at Bessemer City, N.C.

The grease and ceramics industries remained the largest commercial consumers of lithium in 1959. Consumption in welding and brazing alloys, air conditioning, alkaline storage batteries, metallurgy, and pharmaceuticals also continued. Demand for lithium mineral and compounds is, however, below productive capacity, creating one of the industries major problems.

Two contracts between the Atomic Energy Commission and lithium producers expired during the year. (The last contract expires in December 1960.) This made additional plant capacity available. Several years ago additional capacity was thought to be necessary to meet increased commercial demands. The projected increases for lithium products did not, however, materialize.

The long-term outlook for the industry is one of increased consumption of lithium in its established uses and the development of new uses, with emphasis on the metallurgical phases. For the immediate future the industry can expect some rough days; however, optimism rather than pessimism seems to prevail throughout the industry. END

Thorium

James Paone
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CONSUMPTION, principally in magnesium-thorium alloys used in aircraft and missile production, continued to rise.

With the use of thorium already underway in atomic energy, the AEC began a new program for the development of an effective thermal breeder reactor that would make full use of the latent energy in thorium, and re-oriented work on current projects involving use of thorium. The short-term nuclear potential of thorium could not be assessed accurately at the end of the year, but research was under way that might provide answers for the long-range picture.

Production in the Free World remained at nearly the same level as in 1958. Output of monazite, the principal thorium mineral, was on the order of 10,000 tons containing 5- to 6% ThO_2. Domestic production was over 1,000 tons of monazite and thorite concentrates primarily from placer deposits in Idaho and Florida

and from thorite vein deposits in the Lemhi Pass area in Montana. The Van Rhynsdorp monazite deposit in the Union of South Africa met the major requirements of the Free World for thorium; however, the mine operations shut down in 1959 because the market in the U.S. had been curtailed. Both India and Brazil retained embargoes on the export of thorium ores.

Domestic concentrate was produced in Idaho by Agency Creek Thorium & Rare Metals Corp., Porter Bros. Corp., and Baumhoff-Marshall, Inc.; in Montana by Sawyer Petroleum Co.; and in Florida by the National Lead Co. Wah Chang Corp.'s mill at Boulder, Colo., which was processing thorite-type ore from Colorado in 1958, shut down because of a paucity of ore in the area. Thorite from the multihundred-thousand-ton deposit being mined by Sawyer Petroleum on the Montana-Idaho border was said to be similar metallurgically to Colorado ores. Exploration and development of thorium deposits were noted by Northwest Prospecting and Development Co. on Hall Mountain north of Bonners Ferry, Idaho; by New Mexico Thorium Co. in Capitan Mountain in Lincoln County, N.M.; and by Salmon River Uranium Development Co. near Salmon, Idaho. Outlets for the bulk of domestic production were Lindsay Chemical Division, American Potash and Chemical Corp.; Davison Chemical Division, W. R. Grace and Co.; and Heavy Minerals Co., Vitro Corp.

Principal domestic refiners were Lindsay Chemical Division, West Chicago, Ill.; Davison Chemical Division, Baltimore, Md., Pompton Plains, N.J., and Erwin, Tenn.; and Vitro Chemical Co., formerly Heavy Minerals Co., Chattanooga, Tenn. Mallinckrodt Chemical Works, St. Louis, Mo., continued to recover thorium residues for GSA from Idaho euxenites processed primarily for columbium and uranium. Some thorium was offered commercially by Davison Chemical Division, Erwin, Tenn.; Dominion Magnesium, Toronto, Canada; Sylvania-Corning Nuclear Corp., Bayside, N.Y.; Westinghouse Electric Corp., Lamp Division, Bloomfield, N.J.; Horizons Inc., Cleveland, Ohio; National Research Corp., Cambridge, Mass.; Nuclear Materials and Equipment Corp., Apollo, Pa.; Vitro Corporation of America; and Cerium Metals and Alloys Division, Newark, N.J. National Lead Co. of Ohio processed thorium metal for the AEC. Reactor-grade (high-purity) thorium oxide was produced by Davison Chemical Division and by Lindsay Chemical Division. High-purity thorium oxide ceramic also was offered by National Beryllia Corp., Hackell, N.J.

Thorium Prices

Compound (100-lb lots)	Percent ThO_2	Price per lb
Carbonate	80-85	[1]$6.25-8.00
Chloride	50	7.00
Fluoride	80	5.50
Nitrate (mantle grade)	46	3.00
Oxide	97-99	5.50-8.50
Other forms:		
Metal (nuclear grade)[2]		19.55
Thorium hardener (for alloying)	20-40	12.50-15.00

Metal (per lb)	Powder or pellets	Ingot
Less than 10 lb	$50	$54
10 to 100 lb	41	45
100 to 500 lb	34	38
500 to 2,000 lb	26	30
Over 2,000 lb	20	24

[1] Variable depending on rare-earth content.
[2] f.o.b. AEC, Feed Materials Production Center, Fernald, Ohio

Rio Tinto Dow, Ltd., at Elliot Lake in the Blind River area, Ontario, Canada, began operations for recovery of thorium from the waste liquor from a uranium processing plant at Elliot Lake. Output of the 250 tpy of thorium plant is in the form of a 15% crude-thorium concentrate. Some of the concentrate is made into metallurgical grade thorium oxide at the plant and the remainder shipped to the U.S. and England for further processing. Canada's Blind River uranium area contains the largest reserve of thorium on the North American continent. The developed uranium deposits in the area have a thorium content of one part thorium to two parts uranium and reserves are estimated at over 200,000 tons of thorium oxide.

Free World reserves of thorium were estimated at over 1-million tons of ThO_2. Beach and river placer sands of India and Brazil and the Ontario, Canada, uranium deposits constitute the major portion of the reserve; the remainder is from placer and vein deposits in the U.S., Australia, Madagascar, Union of South Africa, Egypt, and other countries.

Prices paid for domestic concentrates probably ranged from $1.75 to $2.25 per lb of ThO_2 content for 20- to 30% thorium concentrates. Price quotations for monazite per pound, c.i.f., U.S. ports were: Massive, 55% REO including thoria, 13c; sand, 55% REO including thoria, 15c; sand, 66%, 18c; and sand, 68%, 20c. (See table.)

The AEC announced that uranium 233 (Fertile) would be leased at $15 per gram.

The major application of thorium continued to be in magnesium-thorium alloys for use in the aircraft and missile industry. Produced chiefly by Dow Chemical Co., eight thorium-bearing magnesium-base alloys were offered during the year and were desirable for strength retaining properties at elevated temperatures combined with light weight and stiffness. Extensive use of Mg-Th alloys was made in the Titan ICBM, the Thor-Discoverer space research vehicles, Jupiter C, Polaris, Talos, Falcon, and Bomarc missiles. In fact, there are probably few missiles, operational or currently under development, which do not incorporate the alloy in some form. The Mg-Th alloys, designated by Dow as HK31A and HK21A are formed as sheet, plate, forgings, castings or extrusions. HK31A-H24 sheet and plate are being used at temperatures up to 550°F and HM21A-T8 sheet and plate are being used at temperatures exceeding 700°F.

Thorium consumption in gas mantle manufacture increased, and refractory and chemical uses of the commodity gained in popularity.

Thorium as a nuclear fuel was being investigated more intensely than in previous programs, under a long-range program announced by the AEC in August. The Thermal Breeder Reactor Program, assigned to the Commission's Oak Ridge Operations Office, is designed to develop effective thermal breeder reactors that would make full use of the latent energy in thorium.

The new program has as its objective the development of a thermal breeder reactor capable of converting thorium to fissionable fuel material at a doubling time of not more than 25 years. (The term "doubling time" refers to the time necessary for a reactor to produce enough excess fissionable material to start up a second similar reactor.)

The new program also involves a re-orientation of work on the Fluid Fuel Reactor Program previously conducted for the Commission by the Brookhaven National Laboratory, Upton, N.Y., and the Babcock & Wilcox Co., Lynchburg, Va., on the Liquid Metal Fuel Reactor (LMFR) concept and by the Oak Ridge National Laboratory, Oak Ridge, Tenn., on the Aqueous Homogenous Reactor (AHR) and Molten Salt Reactor

(MSR) concepts. Much of the work on the projects has been directed toward the development of reactors of these concepts for the production of economic electric power. During fiscal year 1960, research and development on the AHR, MSR, and LMFR concepts, except as applicable to the new program, will be discontinued and a transition of financial support made to the new program.

In the initial phases, the new program will be a basic research and development effort and will include an evaluation of reactor technology to determine the most promising type of thermal breeder reactor for continued long-range development. Any work continued on present fluid fuel reactor concepts will be conducted in the framework of the broader Thermal Breeder Program.

Outlook is good for thorium in magnesium-thorium alloys because of increasing interest and activity in missiles and space technology. Gas mantle manufacture will continue on the same high level of consumption and growing interest in thorium for chemical use indicates a potentially significant market.

Although thorium is currently used in atomic energy, there does not appear to be an immediate prospect of a large demand for nuclear-grade thorium. Should thorium breeder reactors prove economically feasible, demand for metal or oxide could rise significantly. END

Zirconium

F. W. Wessel
U.S. Bureau of Mines

CONSUMPTION of metal during 1959 was principally for military purposes; the excellent performance of atomic-powered vessels to date has led to increased emphasis on a nuclear-powered navy — particularly in the field of submersibles. Present planning calls for 30 submarines in addition to the 19 already under construction or launched. Civilian consumption of the metal was limited. The *N. S. Savannah*, first atomic-powered merchant ship, was launched in July; the power unit reportedly used stainless steel, but zirconium seemed a good possibility for the first replacement elements.

Demand for zircon concentrate rebounded from the 1958 low to approximately equal the 1957 level.

Mallory-Sharon Metals Co. and Carborundum Metals Co. operated throughout the year to produce zirconium sponge. Wah Chang Corp. curtailed its zirconium production early in the year, but continued to install melting and fabricating facilities. National Research Corp., half-owner of the Columbia-National Corp., turned over its share to Columbia Southern Chemicals Co., making Columbia-National a wholly owned subsidiary of the latter company. In November the plant was shut down for extensive alterations.

The Zirconium Association, Cleveland, Ohio, was formed during the year; member companies included the four sponge producers, the Titanium Alloy Mfg. division of National Lead Co., and eleven melters and fabricators.

Allegheny-Ludlum Steel Corp., Westinghouse Electric Co., and four other companies furnished ample melting capacity for the metal.

The expired barter agreement with the Toyo Zirconium Co. (Japan) for reactor-grade sponge was not renewed; the company is supplying purely local demand, and is operating at about 30% capacity. Degussa (West Germany) is reportedly considering zirconium production at Frankfurt a/M.

Consecutive six-month contracts for conversion of hafnium sponge from oxide accumulated under existing AEC zirconium contracts were concluded with Mallory-Sharon Metals Co. and Carborundum Metals Corp. In addition, a separate contract for the reduction of 550 tons of Nigerian zircon (4.5 to 5.5% HfO_2) was undertaken by Carborundum Metals Corp. in Akron, N.Y.

Zirconium Statistics

(Short tons)

	1959 estimated	1958
Domestic zircon production	n.a.	30,443
General imports	50,000	19,275
Average prices	$50	$45
Zirconium sponge production	1,370	1,265
General imports	0	118
Price, reactor-grade, lb	$6	$6

The price of zircon concentrate, both domestic and foreign, averaged $50 per ton. About $150 was quoted for the high-hafnium Nigerian ore. Since the market for rutile remained relatively inactive during the year, zircon prices were under some upward pressure at the year's end. Ocean freight from Australia increased from $19 to $21 per long ton. In addition to the Nigerian material, concentrate from the Umgababa, Union of South Africa, development began to appear on the domestic market.

Production of zircon in Florida by E. I. du Pont de Nemours & Co., Inc., National Lead Co., and Florida Minerals Corp. continued at a somewhat expanded rate during the year. Total production exceeded that of 1958, but did not reach the record production of 1957.

Portions of the National Stockpile of both baddeleyite and zircon were offered for sale by GSA during the year; while many bids were received, no sales were effected.

New commercial developments during the year included the initiation of a joint venture of Harbison-Walker Refractory Co. and Carborundum Metals Co. to exploit various refractories, including zirconia; the development of new alloys of zirconium with copper, tungsten, beryllium, columbium, and titanium for various high-temperature, welding, and electrical purposes; and the development by General Electric Co. of a very small zirconium-filled flash bulb.

Outlook for zirconium metal indicates that principal short-term demand will come from the naval reactor program, but some increased demand should be evident early in 1961 due to replacement requirements for current reactors and installation requirements for new units. General Electric Co.'s reactor program, the admittedly weak Euratom program, and the feasibility studies now initiated at Hanford, Wash. should have an important effect on the market.

Hafnium is still in short supply, and the extent to which the current contracts will satisfy demand remains to be seen. No alternate control rod material seems practical at the moment.

Demand for zircon, lively during the year, may have been to some extent affected by the steel strike and consequent reduction in demand for precision castings; however, the trend of demand appears to be generally upward. END

MINOR METALS

Bismuth

H. M. Callaway
J.S. Bureau of Mines

DIMINISHED domestic metal output, increased industrial consumption, and curtailed imports combined to reduce bismuth stocks during 1959. No purchases were made by Government for the strategic stockpile, and no barter deals were concluded by Commodity Credit Corp.

Domestic output of refined bismuth was almost exclusively from refining lead bullion containing bismuth as an impurity. Keeping the quickening pace of the general economy, production of the metal apparently increased during the first half of 1959 but slowed to a halt in mid-summer when labor strikes closed all major producing plants. At year end the producing industry had only partly recovered.

The pattern of entries established during the first nine months of the year indicates refined bismuth imports declined considerably to 600,000 lb in 1959. Although statistical evidence is lacking, there are reasons to believe imports of bismuth-enriched intermediate smelter products increased somewhat during the year partly compensating for the drop in refined imports. Peru, the traditionally largest contributor, shipped one-fourth less metal. Mexico, the second largest exporter to the U.S., shipped about the same quantity as in 1958 but considerably less than that exported in many prior years. Shipments from Yugoslavia also declined sharply. Accelerated industrial demand in Europe was undoubtedly a factor in lowering U.S. receipts.

Bismuth in refined metal and in alloys was shipped abroad in lesser quantities during 1959. The segment of exports that was refined metal and that which was finished products is unknown. However, the fact of diminished domestic refinery output suggests the drop in exports represented metal needed to satisfy domestic orders.

Consumption rose slightly to 1.3-million lb of refined metal—a 5% increase from 1958. In addition, an unknown imported quantity of bismuth contained in bismuth-lead bars was consumed directly in alloy fabrication. The early months of 1959 continued the downward consumption trend that characterized the preceding year. A quick recovery in the spring and early summer months was arrested by a drop in general industrial activity resulting from labor strikes and seasonal factors. Settlement of strikes in numerous sectors of the bismuth industry caused an upturn during the fall and early winter months, the year ending with a tone of optimism toward 1960.

Bismuth Statistics

(Thousands of pounds)

	1959 estimated	1958
Consumption	1,310	1,242
Imports	600	752
Exports (includes alloys)	250	318
Quoted price, per lb	$2.50	$2.50
Consumers' and dealers' stocks, end of year	450	546

Forty percent of the total industrial use of metal was in low-melting-point alloys and in alloys valued for their controllable dimensional changes. Pharmaceuticals, such as indigestion remedies and ulcer medicine, together with industrial chemicals, such as porcelain pigment and cosmetics, accounted for 30% of the bismuth consumed during the year. The remaining 30% was used in bearing alloys, iron, steel, and aluminum alloys and in experimental and miscellaneous uses.

Anticipated larger increases in demand from semiconductor fabricators and from nuclear reactor experiments did not materialize in 1959. Bismuth telluride remained the most popular thermoelectric element considered for non-mechanical refrigeration and air-conditioning units, but quantities of bismuth necessary to saturate this presently undeveloped outlet was small. Under an AEC contract, experiments continued toward the development of a liquid metal thermal reactor using molten bismuth as the fuel solvent. There seems to be considerable doubt, however, among interested members of the producing industry that nuclear reactors will require significant quantities of bismuth in the foreseeable future.

Stocks of bismuth fell sharply under pressure of increased consumption and decreased imported supply. Metal in consumers' and dealers' warehouses at year end totaled 450,000 lb—down nearly 100,000 lb from the beginning of the year. It seems likely the production loss caused by strikes at primary refineries was reflected by proportionally lowered refiners' inventories. END

Boron

Peter Colefax
American Potash & Chemical Corp.

PRODUCTION during 1959 reached a record 825,000 short tons of $Na_2B_4O_7.10H_20$, and added convincing evidence that it has established itself as a growth product of the chemical industry. Last year's figure, which represented an almost 100,000 ton increase over the preceding year, is characteristic of expanding boron production. In 1940, production was 220,000 tons. By 1950 it had reached 525,000 tons. In less than three decades production of boron has almost quadrupled.

Largest single market is estimated to be the glass and fiber glass industries, which utilized 28% of last year's boron production. Porcelain enamel manufacturers, the second largest consumer, used 14% of output, while weedkiller applications accounted for 10%. Fertilizer, soap, boron compounds and antifreeze manufacturers used 3- to 4% each and the remainder was distributed for use in starch, adhesives, smelters, drug and cosmetics, iron and steel, and other miscellaneous applications.

Products that have received special attention during the past year include boron phosphorus compounds called phosphinoborines, boron-nitrogen materials, boron-oxygen polymers, elemental boron, boron trichloride, boron tribromide, boron alkyls, metallic borides, boron trifluoride, as well as a host of others. New boron-based compounds are currently being examined with considerable interest for possible use in such fields as agriculture, plastics, petroleum additives, rubber chemicals and pharmaceuticals.

Although the boron field has been somewhat deglamorized by the Federal Government's cancellation of contracts for high-energy fuels, the move

had little effect on over-all boron production because the exotic fuels had not yet passed from the small quantity developmental stage into large scale manufacture.

Moreover, American Potash & Chemical Corp., through AFN, Inc., which is jointly owned by American Potash & Chemical (50%), National Distillers & Chemical Corp. and Food Machinery & Chemical Corp. (25% each), continued process development work on boron fuels for the Air Force, as did Aerojet-Stauffer. In addition, the armed services show a continued interest in boron for various applications in the missile field, virtually all of them classified.

Approximately 95% of the Free World's borax is produced by three Southern California manufacturers, American Potash & Chemical, Stauffer Chemical Co. and U.S. Borax & Chemical Corp.

Outside the U.S., there are a number of deposits being worked on a small scale in Europe, Turkey and South America. Russia is believed to be filling its requirements from the low-grade deposits in the Inder Lake region of the USSR.

Production of borax continues to employ two general methods: conventional mining as employed by U. S. Borax at Boron, and chemical extraction as utilized by American Potash and Stauffer.

U. S. Borax, the largest producer, operates an open pit measuring 2,300 ft x 1,300 ft x 250 ft deep. The crushed ore is run through dissolvers at elevated temperatures to create a borax solution. The solution is thickened in four large settling tanks and then concentrated borax from the thickeners is passed to vacuum crystallizers where regular borax and borax pentahydrate are recovered. Water of crystallization is removed by rotary calciners to produce anhydrous borax. The operation, unlike those of American Potash and Stauffer, is devoted to the extraction of a single product. At American Potash and Stauffer, on the other hand, borax is one of a number of products removed from Searles Lake brines. American Potash, for example, manufactures 13 basic chemical products at its Trona plant from the lake brines.

At the Stauffer West End plant, brines from the lake are run into towers where they absorb carbon dioxide. The resulting sodium bicarbonate then is processed to sodium carbonate and, after carbonates are removed from the liquors, borax is crystallized by cooling.

American Potash uses a similar method for extracting borax from brines pumped from the lower of two brine levels in the lake but upper level brine is concentrated in triple-effect evaporators to remove various nonborate salts.

The resulting heated solution of borax and potassium chloride is then cooled to crystallize the potassium chloride, and the liquor sent to the borax plant where it is seeded with sodium tetraborate pentahydrate crystals to precipitate borax from the solution.

Research activity continued at a high level during 1959. U. S. Borax & Chemical is reported to have spent some $1.6-million on research, American Potash about $2-million, and Stauffer about $3-million. All three of the companies are involved in research areas other than boron, and so it is not known how much was devoted to this particular field of endeavor. END

Titanium

D. P. Eigo
Engineering & Mining Journal

WHILE MORE than one producer describes titanium's position in 1960 as "cloudy," most see more blue sky than has been visible since early 1958.

The Department of Commerce estimates mill product shipments for 1960 at 2,600 short tons, slightly down from 3,000 tons shipped in 1959. Shipments of mill products is regarded as a preferred indicator to sponge production, the traditional yardstick of the industry, since the latter was tied to defense production and the former more to non-military demand.

Frank Cservenyak, chief of USBM's Branch of Light Metals, estimates 1959's sponge production at 3900 tons.

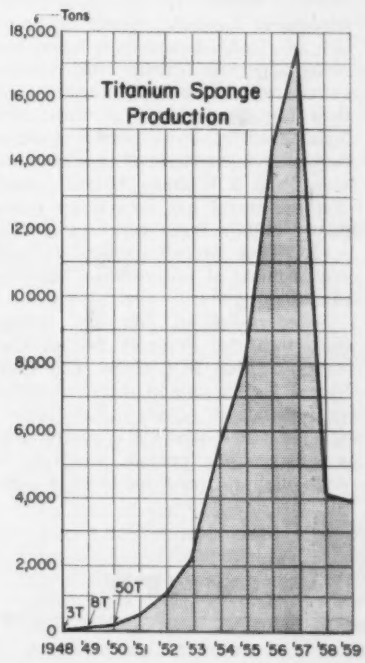
According to Thomas W. Lippert, of Titanium Metals Corporation of America, military aircraft construction in 1960 will largely determine the level of titanium shipments, "because of the developmental nature of missile, ordnance, maritime, chemical and electronic markets.

"Manned military aircraft continued to dominate the markets for titanium in 1959, although two significant developments were recorded.

"1. About 15% of metal shipped was marked for missiles . . .

"2. Approximately 15% of the titanium market in 1959 was in civilian applications, primarily construction of the new commercial jet and prop-jet airplanes, such as the Douglas DC-8, Boeing 707, Lockheed Electra and Convair 880."

Prices were cut again last year by the industry. Sponge, according to Cservenyak and John W. Stamper, commodity specialist, went from $1.60 in 1958 to $1.82 per lb in 1960. The



TMCA composite price (based on sheet, strip, bar and billet) went to $7.22 from $8.66 at the close of 1958.

A new alloy described as superior "in strength, ductility and toughness to any comparable alloy now commercially available" was developed by Dr. Harold Margolin and Paul Farrar of New York University's research division. The alloy nominally contains 85.25% Ti, 6% Al, 6% V, 2% Sn, 0.5% Fe and 0.25% Cu. According to Dr. Margolin, some titanium producers are already supplying the alloy to the armed services for ordnance use.

Another alloy, more exciting to the

zinc industry than in titanium, is "T-Metal," a property of Hydrometals, Inc., which is said by Fred M. Zeder II, president, to combine the "structural strength, stability and scope of other nonferrous metals and, to a significant degree, of mild steel, with all the inherent advantages of zinc itself." The new alloy contains roughly 0.75 to 1.25% copper in the hot strip state, and 0.1 to 0.4 titanium, with the balance in zinc.

Non-military consumption, the long-term hope of the industry, continued to rise. Last year showed promising developments in castings for pumps and valves, platinized anodes for cathode protection and steel cladding.

One-half ton of titanium was built into the airframe of the Douglas DC-8 jet liner, which made its first commercial voyage in September, according to Titanium Metals Corporation of America, who noted that the savings gained through use of the metal are equal to five passengers and their luggage for each of the 5,000 flights each DC-8 is expected to make during its 7-year writeoff. In the same area, Pratt & Whitney Aircraft noted that the metal has racked up more than 1-million flight hours in service in P&W jet aircraft engines without one instance of failure of a titanium part.

Seven miles of titanium tubing went into the Freeport Nickel Co. plants at Moa Bay, Cuba, and Port Nickel, La., in one of the most striking illustrations of the metal's corrosion resistance, where it is performing in a contacting process involving a 98% sulphuric acid solution at high temperature and pressure (E&MJ, December 1959, p 93).

Technology improved in other areas. The all-beta alloy, which can be formed and then heat treated for strength, continued to fulfill its promise, particularly in the defense field, despite one major setback in the missile program. In October, the Army cut back the range of the Pershing missile by 50 miles and switched from titanium rocket motor casings to steel.

In industry, Republic Steel Corp. announced a heat-treatable titanium sheet alloy and a new treating process, which would provide thinner gage sheets with the required strength, offering savings to the aircraft industry.

Mallory-Sharon, which was owned by P. R. Mallory Co., Sharon Steel and National Distillers, was joined by Bridgeport Brass Co. (25%) during the year.

Imperial Chemical Industries, Ltd., of England, teamed with Engelhard Industries, Inc., of Newark, N. J., in production of platinized titanium anodes for use in chlorine-caustic electrolytic cells. Crucible Steel is also producing the anodes and TMCA is carrying out laboratory tests with a new anode. All suppliers of mill products report progress in the machining, handling, forging, etc., of the metal as use increased.

The USBM announced improved electrorefining techniques for titanium with a fused salt electrolytic cell which is internally heated, and BDSA noted that induction melting of titanium scrap produced castings "with mechanical properties almost as good as forged titanium." END

Mercury

J. R. O'Connell, Jr.
Engineering & Mining Journal

THE MARKET FIRMED late in the first quarter, to the surprise of many observers, and hit its peak in May. The price slump predicted for February developed in the second half. Prices dropped steadily to the end of the year.

The U.S. Government buying program for domestic and Mexican mercury at a floor of $225 ended on Dec. 31, 1958. Deliveries were accepted through Jan. 31, 1959. A total of 26,891 flasks of domestic and 3,274 Mexican was purchased under the program—17,463 domestic and 2,508 Mexican flasks in 1958. The program terminated despite a plea for assistance from the domestic industry. The Tariff Commission took no action after a lengthy industry investigation in 1958.

January saw the E&MJ low at $218 per flask (76 lb), New York. European producers had withdrawn from the market in late 1958. Domestic producers, who had struggled to push every last flask to the Government before the deadline, made no effort to speed output for shipment to U.S. consumers. Buyers, who envisioned drastically reduced U.S. prices once GSA support ended, maintained a lack of buying interest that had begun in the final quarter of 1958. The market was dull throughout January.

The question was how long European producers would remain out of the market. It was surprisingly long. Their reluctance to sell at market levels except in vast quantities, coupled with the abstinence of one large domestic producer, poor weather, and a West Coast trucking strike, helped drive the price sharply upward in March. Spain and Italy combined shipped a meager 160 flasks to the U.S. for consumption in the first quarter.

A limited supply of domestic and good quantities of Mexican metal satisfied February demand, but proved inadequate in March. Bone-dry consumers convinced that prognosticators had erred in forecasting lower prices, rushed into the market. Prices zoomed to a range of $245 to $249 in April.

The market was squeezed in April and May. Buying urgency brought sky-high bids as sellers with metal hesitated, looking to better prices. Consumption jumped from 11,900 flasks in the first quarter to 18,300 in the second. Mexican metal, bringing top prices in Europe, was rarely available. European producers, selling on a quantity basis, returned to the market.

The pinch subsided as quickly as it had developed. With a softening in Europe, Mexican material, with its usual discount of $2 to $3 in a down trend, led prices off. An announcement by GSA that some mercury might be sold helped keep buyers away. Consumers, now well stocked, and faced with abundant supplies from all sources, resumed hand-to-mouth buying tactics. European sellers returned to a flat-price selling basis.

The market was dormant with the coming of summer. Few large-lot buyers were to be found and mercury began slumping in its periodic high-low cycle. Selling competition was intense. Some buyers, seeking bargains, went directly to domestic and foreign sources.

Prices were regularly slashed. The E&MJ average fell $5 in June, $4 in July, $7 in August and $6 in September. Third quarter U.S. consumption dipped 42%.

European sellers, as they frequently do, rode down with the market. They stuck with it longer than expected, but when quotations dropped below $215, New York, they announced withdrawal.

The ability of one heretofore minor West Coast producer to sell good quantities at reduced prices set the pattern of the market. Observers called it a "lucky strike" at an unproductive property. This high-grade, low-cost material, in the hands of several dealers instructed to get the business, became exceedingly attractive to reluctant buyers. Sellers unable to compete defended the efficiency of the operation and cited it as a glittering example of the American free-enterprise system. Nonetheless, because of market conditions at the time of the strike, pressure was brought to bear on the domestic industry. Less efficient producers were forced to shut down.

European producers, with producing capacities that lead the world, for once were not blamed for the sharp break in prices. Their output is needed to supplement the domestic yield, in order to satisfy U.S. consumer requirements; but their position is often precarious. U.S. laws guard against price collusion on the part of domestic sellers, thus when prices crowd costs of the domestic mercury industry, attention is focused on the influence of foreign metal. Should at any time the Tariff Commission decide that pressure on the U.S. industry is too great, she stands ready to suggest raised tariffs or imposition of quotas. Foreign producers are well aware of their vulnerability and are generally unwilling to risk low-level markets here. When U.S. prices are below European quotations, reluctance is expedient.

New York prices were at $212 to $214 at the close of 1959. They dropped to $211 early in January 1960. Downward pressure subsided later in the month.

A leading East Coast refiner contracted for the entire output of the West Coast producer discussed above. With the signing of the country's newest big producer, a large percentage of domestic output has been contracted for. There will be less domestic material on the open market in 1960.

In Mexico, where production is more difficult than in the U.S. or Europe, mines have been demanding higher prices. Mexican metal was not a factor in the recent U.S. price decline. With European quotations higher—less duty: $200, on paper—the current domestic market remains unattractive.

Mercury barter during the year was limited. About 6,000 flasks, the remainder of a 16,000-flask deal begun in late 1958, arrived from Spain in the first quarter. No further deals were announced. Word is that the Commodity Credit Corp. of the Department of Agriculture is willing to barter for mercury. Barter deals in 1960 are likely in view of sporadic U.S. demand and the absence of a U.S. Government floor price.

Mercury Statistics

	1959	1960
Mine production	32,000	38,067
Secondary	4,800	5,400
Total	36,800	43,467
Stocks end:		
Producers	1,500	674
Consumers, dealers	9,000	10,600
Total	10,500	11,274
Imports (Gov't & Industry):		
Dutiable	24,000	21,000
Free	8,000	11,000
Total	32,000	32,000
Exports	320	320
Consumption	52,000	52,617
To GSA	0	(b)17,463
Price(a)	$227.484	$229.057

(a) Final. (b) Domestic only. U. S. Bureau of Mines figures for 1958 and estimates based on USBM third quarter 1959 data.

The usual mercury market cycle can be expected in 1960. Domestic and Latin American metal—insufficient to fulfill U.S. needs—will supply the market until the price moves up enough to attract European producers. Activity in Europe is generally the key to the amount of metal shipped here. If good, metal will be attracted there. If slow, a firm U.S. market will see additional metal. The market generally slides with the quantity of metal introduced here.

Indications are for a good business year in 1960. Some of the slack in the mercury market caused by cessation of GSA buying was absorbed in 1959 by decreased domestic output. Should U.S. consumption improve and some metal be siphoned off the market through barter, a yearly E&MJ average of between $225 and $230 can be expected. There is practically no chance of a tight supply situation in 1960 from other than artificial means. This does not preclude an occasional price pinch, however. END

Platinum Metals

J. P. Ryan
U.S. Bureau of Mines

INCREASED industrial demand and a tightening of the world supply brought higher prices for platinum metals in 1959. The quantity of platinum metals offered by the USSR at prices below the official market price declined sharply and surplus stocks of Free World producers were reduced. U.S. imports, refinery production, and consumption of platinum metals rose substantially during the year. Significant quantities of palladium and ruthenium were acquired for the Government stockpile through exchange of surplus agricultural products under the barter program.

As in preceding years the bulk of domestic requirements of platinum metals, comprising about three-fourths of the world output, was supplied by Canada, Union of South Africa, and the Soviet Union. Domestic sources of platinum metals consisting of placer deposits in Alaska, by-product metals from gold and copper refining, and secondary metals recovered by refiners, furnished less than 12% of the nation's requirements.

Output of platinum metals in Canada increased moderately during the year, following a return to more normal operations by the International Nickel Co. after a labor strike in the latter part of last year.

The scale of operations also increased at Rustenburg Platinum Mines, Ltd., in the Union of South Africa after having been sharply curtailed during 1958. With expanded operations at the mines of the two largest producers, world production of platinum metals is estimated to have increased about 20% in 1959 to approximately 1-million oz distributed as follows: Union of South Africa, 366,000; Canada, 354,000; Soviet Union, 250,000; Colombia, 16,000; U.S. 14,000.

Increased demand by chemical industries, including petroleum refining and glass manufacturing, together with increased requirements of electrical consumers, accounted for nearly all of the gain in platinum sales during the year. The quantity of platinum absorbed for jewelry and decorative uses also increased. The gain in

palladium sales reflected a sharp increase in demand for electrical and electronic uses which more than offset a drop in requirements for chemical uses. Palladium requirements for dental and medical and for jewelry and decorative purposes declined.

Domestic refiners and dealers reported platinum sales to consuming industries of 232,900 oz for the first nine months of 1959, of which about 58% were for chemical uses including petroleum refining and glass manufacturing; 21% electrical; 3% dental and medical; 14% jewelry and decorative; and 4% for miscellaneous uses. The price per troy ounce of platinum rose from a low range of $51-$55 in January to $67-$80 at the end of February and $75-$80 in March after which it remained virtually unchanged for the remainder of the year.

Sales of palladium to domestic consumers reported by refiners and dealers for the first nine months were 296,800 oz, about three-fourths of which went to electrical and electronics industries; 11% for chemical uses; 5% dental and medical; 6% jewelry and decorative and 2% miscellaneous. The nominal price of palladium rose from a low range of $15-$17 a troy oz at the beginning of the year to $16-$18 in February, $18-$20 in March, $20-$22 in October, reaching a high of $22-$24 in November, and remaining unchanged thereafter.

Domestic sales to consuming industries of the minor platinum metals, iridium, osmium, rhodium, and ruthenium, aggregated 28,800 oz for the nine-month period, a gain of 50% over last year. The price of iridium rose from $70-$80 in January to $75-$80 an oz in February and remained unchanged thereafter; osmium remained unchanged at $70-$90; the price of rhodium was increased from $118-$125 an oz in January to $122-$125 in February and remained unchanged to the end of the year. Similarly, the price of ruthenium was raised from $45-$55 to $55-60 an oz in February and remained unchanged thereafter.

It is difficult to forecast price trends or consumer demand for platinum metals; however, continuance of international tension and sustained industrial activity, particularly in the chemical, glass fiber, electrical, and steel industries should maintain demand for platinum-metals at a moderately high level. Stocks of platinum held by petroleum refiners appear to be at a relatively low level and any expansion of reforming facilities will probably require additional quantities of platinum. Furthermore, platinum requirements of foreign refineries are expected to increase as new productive facilities for high-octane gasoline are constructed. Prices of platinum and palladium are sensitive to changes in the supply-demand situation and will be determined, to a large extent, by the marketing actions of the Soviet Union.

In view of the large surplus productive capacity in the Union of South Africa and new sources of supply under development in Canada, the world outlook is for ample supplies of platinum metals.

Based principally on their superior resistance to high-temperature oxidation and chemical corrosion and outstanding catalytic characteristics, new applications of the platinum metals will continue to be developed through research and may lead to increased consumption in such fields as air pollution control, space vehicle construction, and electronic equipment manufacturing. END

Platinum-Group Statistics

(Thousands of troy oz)

	1959 9 months	1958 9 months
Platinum-Group		
Imports	**738.9**	489.1
Domestic refined	**129.4**	59.6
Domestic consumption	**558.5**	457.5
Platinum		
Domestic sales and exports	**246.8**	205.9
Imports and domestic refined	**314.1**	223.5
Palladium		
Domestic sales and exports	**307.2**	268.6
Imports and domestic refined	**503.1**	298.2
Iridium, Osmium, Rhodium, Ruthenium		
Domestic sales and exports	**29.9**	20.1
Imports and domestic refined	**51.2**	27.0

Rare Earths

BECAUSE of the growing interest in the rare earths and their compounds, E&MJ has begun publishing the metal and oxide prices of Lindsay Chemical Div., American Potash & Chemical Corp. in E&MJ METAL & MINERAL MARKETS.

Prices of the metals, as shown in the table at the left, are effective April 1, 1959, fob West Chicago, Ill. Quotes, except thorium, are for ingot or lump. Prices for larger quantities are available on request. The minimum order is $3.

Rare earth oxide prices are presented in the table at the right and are effective Jan. 1, 1959 on a delivered continental U.S. basis, net 30 days. Prices for rare earth salts: acetates and sulphates are 75% of the oxide price; oxalates, chlorides and nitrates, 60%; carbonates and fluorides, same as oxide. END

1959 Metal Prices

Metal	Grade	Per Gram 10-99 gm	Per Gram 100-450 gm
Lanthanum	99.9%	$0.51	$0.34
Cerium	99.9%	0.50	0.33
Praseodymium	99.9%	0.63	0.42
Neodymium	99.9%	0.63	0.42
Samarium	99.9%	0.66	0.44
Europium	99.9%	13.90	9.25
Gadolinium	99.9%	1.10	0.73
Terbium	99.9%	5.63	3.75
Dysprosium	99.9%	1.10	0.73
Holmium	99.9%	1.10	0.73
Erbium	99.9%	1.10	0.73
Thulium	99.9%	6.93	4.62
Ytterbium	99.9%	1.89	1.26
Lutetium	99.9%	12.87	8.58
Yttrium	99.9%	0.81	0.54
Yttrium	80%	0.63	0.42
Yttrium-Mg alloy		0.36	0.24
Thorium powder		0.15	0.10

1959 Oxide Prices

	Grade	Per gm 1-99	Per gm 100-gm	Per lb
Lanthanum oxide	99.99%	Small lots only		
Cerium oxide	99.997%	Small lots only		
Neodymium	99%	$0.15	$0.13	$ 35
oxide	99.9%	0.20	0.15	40
Praseodymium	99%	0.20	0.15	40
oxide	99.9%	0.25	0.20	50
Samarium	99%	0.25	0.20	50
oxide	99.9%	0.30	0.25	60
Europium	99%	4.50	3.00	850
oxide	99.8%	5.00	4.00	900
Gadolinium	99%	0.55	0.40	105
oxide	99.9%	0.65	0.43	125
Terbium	99%	4.50	3.00	850
oxide	99.9%	5.00	4.00	900
Dysprosium	99%	0.55	0.40	105
oxide	99.9%	0.65	0.43	125
Erbium	99%	0.55	0.40	105
oxide	99.9%	0.65	0.43	125
Yttrium	99%	0.30	0.20	60
oxide	99.9%	0.35	0.25	70
	99.99%	0.40	0.30	80
Holmium	99%	0.55	0.40	105
oxide	99.9%	0.55	0.43	125
Ytterbium	99%	0.70	0.53	160
oxide	99.9%	0.90	0.70	200
Thulium	99%	4.50	3.00	850
oxide	99.9%	5.00	4.00	900
Lutetium	99%	5.30	4.00	1200
oxide	99.9%	6.70	5.00	1500

Ferroalloys

Robert W. Holliday
Commodity Specialist
U.S. Bureau of Mines

Tungsten production in the U.S. came from only two producers and mines in many other areas of the world were closed or operating at less than capacity. p 139

Dr. John M. Warde
Union Carbide Ore Co.

Chrome ore's outlook for 1960 is for a generally higher level than 1959. Barter is again expected to play a role in the market. p 142
Manganese inventories at present are large. p 140

J. H. Bilbrey, Jr.
Commodity Specialist
U.S. Bureau of Mines

Nickel output in 1959 leaped upward 26%. Inco recovered quickly from the 1958 strike. p 139
Cobalt production increased 18% in 1959. Use in high-temperature alloys improved by 14%.

Wilmer McInnis
Commodity Specialist
U.S. Bureau of Mines

Molybdenum production in the Free World was about 25% increased. Production in 1960 should be ample for an expected 60- to 70-million lb Free World demand. p 138

Cobalt

J. H. Bilbrey, Jr.
U.S. Bureau of Mines

Cobalt Statistics

(Thousand pounds)

	Metal		Oxide (gross wt)	
	1959 (9 mo.)	1958	1959 (9 mo.)	1958
U. S. Production	2,134	3,702	200	292
U. S. Imports	10,294	15,719	1,089	837
Belgium—Belgian Congo	7,587	12,349	1,008	773
Canada	381	1,065	82	64
France	44	14	—	—
Northern Rhodesia	645	817	—	—
Norway	603	737	—	—
United Kingdom	—	13	—	—
West Germany	1,078	713	—	—

FREE WORLD production of cobalt increased an estimated 18% in 1959. Production is estimated at 17,300 short tons compared with 14,600 in 1958.

U.S. imports of cobalt for the first nine months of 1959 were 15% higher than for the corresponding period of 1958. Increases in imports of metal were noted for Belgium and the Belgian Congo (22%), France (213%), Norway (13%) and West Germany (131%) while decreases were recorded for Canada (56%) and Northern Rhodesia (21%). Imports of oxide, chiefly from Belgium, increased 97%. No ore, concentrate or white alloy were imported by the U.S. during the first nine months of 1959.

United States production of cobalt metal during the first nine months was 18% lower than for the corresponding period in 1958, but imports were up 15%. The decrease in production was due in part to the temporary suspension of operations of Bethlehem Cornwall Corp. caused by the steel strike and partly due to the decrease in production by the Calera Mining Co. prior to the complete suspension of its operations. Production of oxide declined 14% while imports increased 97%. Production and shipments of salts and driers are shown in the table. (Cobalt content in lb):

	1959 (9 mo.)	Percent change
Production		
Salts	150,171	−37
Driers	606,154	+22
Hydrate	93,591	+ 7
Shipments:		
Salts	148,714	−36
Driers	585,813	+18
Hydrate	83,340	−15

Consumption of cobalt totalled 5.1-million lb during the first six

months of 1959 compared with 3.4-million lb for the corresponding period of 1958. Consumption for manufacture of permanent-magnet alloys was the largest single item, accounting for 30% of the total, with 68% more cobalt used for this purpose than in 1958. High-temperature alloys accounted for 23% of the total (14% more used than in 1958).

Bethlehem Cornwall Corp., Calera Mining Co., and National Lead Co. continued to be the only producers of concentrate from domestic ores. The Bethlehem Cornwall plant in Pennsylvania was shut down for the duration of the steel strike, and the Calera mine and mill in Idaho were closed indefinitely in mid-year, due to the inability of the company to produce competitively with foreign cobalt. Production (cobalt content) during the first nine months was 2.51-million lb, compared with 3.48-million lb for the corresponding period of 1958.

The Garfield, Utah, refinery of the Calera Mining Co. was closed in September 1959 after refining enough metal to meet contract commitments. Production of metal and other products at the refinery of the Pyrites Co., Wilmington, Del., was temporarily suspended during the steel strike. The refinery of National Lead at Fredericktown, Mo., operated steadily during the entire year.

Foreign output of cobalt increased in 1959. Most notable was the reentry of New Caledonia into the cobalt production picture. Construction of the new Luilu refinery of Union Miniere proceeded on schedule, and production is expected to start in 1960. Freeport Nickel Co., completed construction of its cobalt and nickel mining and concentrating plant at Moa Bay, Cuba, and its refining plant at Port Nickel, La. The refinery was designed to produce 4.4-million lb of cobalt per year and production was originally scheduled to start during the last quarter of 1959. Political developments in Cuba, however, have caused delays for the present.

African Metals Corp., the U.S. sales agency for cobalt produced by Union Miniere, announced a cut in the price of cobalt metal from $2.00 per lb to $1.75 per lb effective Feb. 1, 1959. All of the other cobalt suppliers followed the lead of African Metals and dropped their price to the same level, with the exception of International Nickel. Inco maintained the price of its cobalt at the $2.00 level in the belief that it could get a premium price for what it considered a superior material. END

Molybdenum

Wilmer McInnis
U.S. Bureau of Mines

1959 was a more prosperous year for the industry than 1958, despite labor strikes in the domestic steel and copper industries. Free World production of molybdenum was up about 25% and both domestic and foreign demand increased substantially compared with 1958.

U. S. production of molybdenum during 1959 was estimated at 52-million lb compared with 41-million lb in 1958. Output during the first nine months of 1959 totaled 39.4-million lb, a 33% increase over production during the same months of 1958. Production from the Climax Molybdenum mine in Colorado was up 37% compared with the same period in 1958, and the quantity recovered as a by-product of copper and tungsten increased 26% despite the labor strikes at several of the copper plants.

Duval Sulphur & Potash Co. completed the construction of a molybdenum recovery unit at its copper plant in Arizona early in the year and started recovering molybdenum from copper concentrate produced from the ores of its Esperenza mine. Miami Copper Co., a producer of molybdenum since 1958, shut down its molybdenum recovery unit at the end of June when underground mining of its Miami mine was discontinued.

Total Free World production of molybdenum in 1959 is estimated at 57.5-million lb, compared with slightly less than 46-million lb in 1958. The principal foreign producing countries were Chile, Canada, Japan, and Norway. Output in Chile during the first nine months of the year totaled 2.7-million lb; all recovered as a by-product of copper. Production in Canada was largely from the La Corne mine in Quebec. In Japan, molybdenum was produced from several small operations, and in Norway it was produced from the Knaben deposit where systematic molybdenum mining first began. The Republic of the Philippines was reported to have become a new source for molybdenum in 1959 when the Marinduque Iron Mines started by-product recovery of molybdenum from copper concentrate produced from the ores of its Sipalay Copper mine.

Domestic producers of molybdenum products consumed 29.6-million lb of molybdenum contained in concentrate during the first nine months of the year, compared with 22.4-million lb in the same months of 1958. Nearly all of the concentrate was converted to molybdic oxide. Of the 26.9-million lb of molybdenum contained in the oxide produced, 8.3-million lb was used in producing ferromolybdenum, metallic molybdenum, and molybdenum compounds, 1.9-million lb was shipped for export, and the rest went to domestic consumers for use in making steel and other end products.

Domestic consumption of molybdic oxide and the other molybdenum products increased 66% during the first six months of the year compared with the same months in 1958. However, consumption during the last half of the year declined sharply because of the long labor strike in the steel industry which is by far the largest consumer of molybdenum. Of the 18.9-million lb of molybdenum consumed during the first half of 1959, 87% was used in producing iron and steel products, 2% was used in making special alloys for high-temperature applications, 5% for metallic molybdenum products, and 6% in the manufacture of lubricants, pigments, and other nonmetallic products.

U.S. exports of molybdenum were up sharply for the year after a rather slow start in the first quarter when less than 3-million lb was exported. Exports of concentrate and molybdic oxide during the first nine months contained about 12-million lb molybdenum of which 34% was shipped to West Germany, 18% to the U.K., 12% to France, 10% to Austria, and the rest to eight other countries.

Exports of molybdenum from Chile during the first nine months of 1959 totaled 3.4-million lb, all to Europe.

In line with U.S. Government policy for upgrading certain materials held in the National Stockpile, GSA solicited proposals for the production of molybdic oxide and ferromolybdenum from a quantity of Government-owned molybdenite concentrate.

There were no changes during the year in the prices quoted for most

molybdenum products. The prices quoted were: Molybdenite concentrate $1.25 a lb contained Mo, f.o.b. Climax, Colo, plus cost of container; Molybdic oxide, bagged $1.46, canned $1.47 a lb contained Mo, f.o.b. shipping point; ferromolybdenum, powdered $1.82, other sizes packed $1.76 a lb of contained Mo, in lots of 5,000 lb or more, f.o.b. shipping point; and calcium molybdate $1.50 a lb contained Mo.

Outlook for molybdenum in 1960 is good. Production should be ample to meet Free World demand which is expected to be on the order of 60 to 70-million lb. END

Tungsten

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U.S. Bureau of Mines

DOMESTIC mine production in 1959, as in the last half of 1958, came from only two producers. Union Carbide Nuclear Co. continued to operate the Pine Creek mine near Bishop, Calif., and American Metal Climax, Inc. produced by-product tungsten at the Climax Molybdenum mine near Leadville, Colo. In September, the Minerals Engineering Co. began stripping operations in Montana.

Tungsten mines in many other areas of the world were closed or operating at less than capacity. Although statistical data are not available, world production undoubtedly declined. The last U.S. Government stockpile purchase contract was fulfilled in 1959.

U.S. imports of concentrate in the first nine months of 1959 were 4.8-million lb tungsten content, compared to 5.2-million lb in the first nine months of 1958. Brazil (1,095,000 lb), Republic of Korea (840,000 lb), Bolivia (699,000 lb), Portugal (532,000 lb), and Australia (487,000 lb) supplied 75% of the total. Eleven other countries supplied 25%.

E&MJ price quotations for imported concentrate c.i.f., U.S. ports, duty extra, ranged between $10.75 and $13 until the first part of September. Prices increased then to a peak of $20-$20.75 and closed the year at $18. The British Government reportedly sold stockpiled tungsten concentrate, in September, for the first time since the 1957 decline in price.

Domestic consumption of concentrate increased by at least 60% compared to the previous year, and preliminary data indicate that the total may be close to 9-million lb. In the first six months of 1959, 38% of consumption was in steel; 25% was in cemented carbides; 9% was in cast carbides; 14% was in metal (wire, rod, sheet, and forging billets).

Research. Important results of recent research on tungsten were evident in 1959. This was especially so with regard to fabricating techniques. Improved powder metallurgy made possible the production of large billets suitable for forging. Progress also was reported in development of arc and electron beam melting. The Bureau of Mines reported development of a vapor deposition method of producing extremely pure tungsten. The method, involving hydrogen reduction of tungsten hexafluoride, may also prove useful as a means of producing shaped parts. Slip casting of large parts and application of spinning techniques to tungsten were announced by industry, and promising results were obtained by explosive forming methods. The plasma jet torch, capable of developing extremely high temperatures, was used in tungsten fabrication.

The long-term outlook for tungsten is for increased consumption. Conventional uses in alloys, in carbides, and as pure metal should continue and an additional increment of consumption should develop in applications involving temperatures of 2000°F to 3000°F and above. END

Nickel

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U.S. Bureau of Mines

PRODUCTION and consumption of nickel increased markedly in 1959 in spite of the retarding effect of the steel strike. Stocks of nickel at consumers' plants at the end of September amounted to about 23-million lb.

Free World production of nickel for 1959 is estimated at 240,000 short tons, an increase of 26% over 1958.

U.S. imports of nickel for the first nine months were 93,100 tons (nickel content), down 2% from the corresponding figure for 1958. Imports from Cuba and Norway were up 31- and 20% respectively, while imports from Canada decreased 5%. Imports from the U.K. rose from 23,000 lb during the first nine months of 1958 to 706,000 lb for the same period in 1959.

U.S. consumption of nickel through September totalled 84,100 tons, an increase of 53% over 1958.

Nickel Statistics

(Short tons)

	1959 estimated	1958
United States		
Imports	**130,000**	108,000
Consumption	**115,000**	79,000
Canada		
Production	**183,000**	139,559
Exports to U. S.	**85,000**	69,905
Cuba		
Production	**19,000**	19,782

Producers. International Nickel Company of Canada, Ltd., got off to a slow start in 1959 due to the aftereffects of a three-month strike of its employees ending Dec. 22, 1958. Production was increased at a rapid rate, however, and the production for 1959 is estimated to be well above that for 1958 and may approach the record year of 1957. Development of the new Thompson mine continued on schedule, and Inco decided to build a refinery close to the mine. The refinery will use the matte electrolysis method recently developed by Inco researchers. Present plans call for production to start in 1960 and reach the rated capacity of 75-million lb nickel a year in 1961. In August, officials of GSA and Inco reached an agreement whereby the Government would be relieved of all existing obligations to purchase nickel from Inco for the stockpile. Approximately 26-million lb of nickel was involved.

Falconbridge Nickel Mines, Ltd., continued to produce at a high rate, and by mid-year was operating at a rate of 55-million lb a year. Production was expected to be substantially larger than the previous record year of 1958 in which over 50-million lb of nickel in matte was produced.

FERROALLOYS

A new company, Giant Nickel Mines, Ltd., reopened the property formerly known as the B. C. Nickel mine in June 1959. The plant has a daily milling rate of 1,000 tons, and contracts for the delivery of concentrate have been made with Sherritt Gordon and the Sumimoto Metal Mining Co., a Japanese firm.

Sherritt Gordon Mines, Ltd., operated at a slightly higher rate than in 1958. Contracts were made with North Rankin Nickel Mines, Ltd., for the purchase of up to 28-million lb of nickel in concentrate over a four-year period and with Giant Nickel Mines, Ltd., for the purchase of up to 8,000 tons of concentrate before June 1960. Sherritt Gordon renegotiated its contract for the delivery of nickel to the Government stockpile to allow final delivery to be completed by the end of 1961 instead of 1959.

Output by the U.S. owned plant at Nicaro, Cuba, was slightly lower than in 1958 for the first 10 months of the year.

Construction of the mining and concentrating facilities of Freeport Nickel Co. in Moa Bay, Cuba, was completed late in 1959, several months behind schedule. Subsequently, activity at Moa Bay was suspended pending clarification of the provisions of the new Cuban mining law as applied to Freeport's operations. The refinery at Port Nickel, La., where nickel and cobalt will be produced from Moa Bay sulphide concentrate was finished several months earlier and approximately on schedule.

Hanna Nickel Smelting Co., in Riddle, Ore., operated at slightly above rated capacity during the first 10 months of 1959, and production for the year is estimated at about 22-million lb nickel in ferronickel as compared with slightly over 21-million lb in 1958.

National Lead Co., Fredericktown, Mo., produced 15% more nickel during the first 10 months of the year than during the corresponding period of 1958. END

Manganese

Dr. John M. Warde
Union Carbide Ore Co.

IN 1960, U.S. ore consumption should show substantial improvement over the previous year. Steel production, which accounts for over 90% of the ore requirement—mainly in the form of ferroalloys—has been predicted to range from 120- to 140-million ingot tons in 1960. Even the lower of these estimates tops the all time high of 117-million tons recorded in 1955 and represents a 30% increase over the 93-million tons produced in 1959. A high level of activity is predicted for other steel producing countries, which also argues well for manganese demand.

After a greatly depressed year in the manganese ore market in 1959, buyer interest began to show some signs of activity as 1960 commenced due to the spurt in U.S. steel output in December 1959. World oversupply, which has plagued the manganese ore trade through 1959, was still a prime factor at the beginning of 1960. Year-end inventories in the U.S. were estimated to be at a record high as the already large stocks accumulated in the 1958 recession year and carried over into 1959 were further increased by the prolonged steel strike. Stocks held by U.S. consumers are estimated at the equivalent of 10 to 11 months supply even at the 1957 peak level of ore usage and most of the anticipated replacement requirements for 1960 are said to be already contracted for. Year-end ore stocks in other steel producing countries are reported to be at a comfortable level and the rate of replacement under current contracts is expected to be more or less equivalent to the rate of withdrawals.

U.S. Manganese Ore

(Thousands of short tons)

	1959 estimated	1958*	1957*
Production...	225	323	366
Consumption..	1,550	1,498	2,361
Imports.....	2,300	2,453	3,105
Stocks, end...	2,100	2,041	1,547

*Source: U.S. Bureau of Mines.

As 1960 began, ferromanganese was reported to be in good supply in the continental market. The most competitive new supplier in the European ferromanganese market is the Union of South Africa's new Cato Ridge plant operated by Feralloys, Ltd. The first furnace was tapped in August 1959, and the initial installation includes two 900 KVA electric furnaces out of the eight planned. Manganese ore supply comes from new producing areas in the Kurumau district.

India, which has formerly supplied small quantities of ferromanganese, is expected to enter the market with large tonnages late in 1960 as a result of its recent expansion of capacity. India's requirements for ferromanganese by middle 1961 are estimated at 60,000 tons per year. By that time, production capacity is expected to reach 171,800 tons, leaving a surplus for export of more than 100,000 tons per year. Australia and the Philippines also have plans for ferromanganese production, primarily for local consumption. Japanese producers anticipate increased alloy exports in the coming year. Manganese ore consumption in Japan is expected to rise to 780,000 tons by 1970 from 410,000 tons in the fiscal year ending March 31, 1959. Significant new developments in the production of manganese metal in 1959 were the announced increase in capacity of Japanese producers and the reports of new electrolytic manganese production in Czechoslovakia.

Barter is expected to play an increasingly important role in the manganese trade in 1960. The "big Indian Deal," which involves trading 450,000 tons of U.S.-owned wheat with India for up to 175,000 tons of 46% Mn ore, and up to 100,000 tons of ferromanganese, is expected to be finally implemented in 1960. Although the subject has been under discussion since 1957 and an "agreement in principle" was signed in March 1959 between the two governments, price details were apparently not settled until early December, when the U.S. formally announced it was ready to receive Indian manganese offers through U.S. firms to implement the agreement. By law, the Indian manganese received in the deal will be frozen in the Government's stockpile. Observers are speculating on a step-up of manganese barter with India as a result of the President's recent visit. The U.S. barter program was also an important factor in ferromanganese trade in 1959 and transactions were reported with Western European producers and Japan.

In the long-range ore supply picture, most significant news in 1959 was the advance of plans for developing the Moanda deposits, in Gabon (formerly French Equatorial Africa), largest potential new world source of high-grade manganese. Sites are

reported to have been chosen for the first working unit and it was announced that a railway will be built by an engineering consortium of French, U.S., and U.K. firms. The International Bank announced a $35-million loan for the project to Comilog, a French company in 1939 which U.S. Steel has an interest.

Other mining developments in 1959 which add to future ore supplies include the development of manganese deposits in British Guiana and Urucum in Brazil, the announcement that the Comp. Mokta El Hadid expects to commence mining operations in 1960 at an annual rate of 100,000 tons per year of 48% Mn from the Grand-Lahou manganese deposits of the Ivory Coast—which have a reported reserve of 1.3-million tons of ore minable by open pit methods and reported new manganese mining operations in Indonesia and Thailand. Demag, a West German machinery company, is reported to have concluded negotiations to exploit manganese deposits in Egypt on the Sinai Peninsula. The Soviet Union has announced that a large new open pit mine is being developed in Eastern Siberia and two new mines with their own beneficiation plants are to be opened in Chiatura. Exploration activities in 1959 include reported discoveries of new deposits of manganese ore in the New Hebrides and Yugoslavia. The South African Railways are reported to have agreed to build and operate a 40-mile extension in the Kuruman district which will increase manganese shipments from that important area.

In 1959, U.S. consumption of manganese ore was seriously affected by the steel strike, which caused ferroalloy producers to drastically reduce their output. Alloy demand was reflected in the progress of steel output which was at 84% of capacity in the first quarter, rose to 92% in the second quarter and then slumped to 22% in the third quarter as the strike took effect. Extension of the strike into November held down the last quarter output to 56% of capacity.

Domestic production of manganese ore in 1959 fell off sharply as the Government's "carlot program" was brought to a close in early August, having acquired the 28-million long ton units of Mn called for. Despite the introduction of a number of legislative bills designed to continue the program, most observers see little chance for an early extension either by administrative action or legislation.

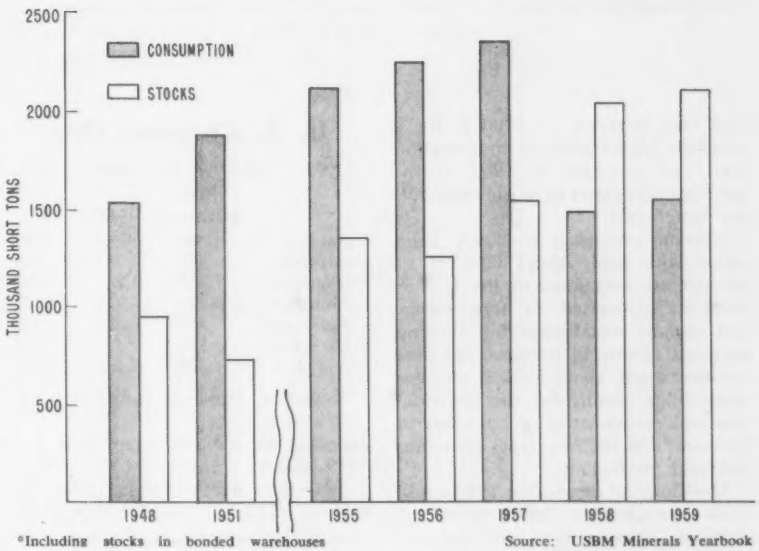
U.S. imports of foreign ore in 1959 were again dominated by Brazil which outsupplied India, second largest source, by more than 2 to 1 to furnish about 40% of U.S. needs, according to customs returns at the end of 10 months. Brazilian ore came mainly from Amapa (ICOMI-Bethlehem Steel) which in addition to supplying private firms has a contract for supply to the U.S. Government.

India, a major ore source, had anothher difficult year. Production in 1959 is estimated at slightly more than 1-million tons, about 200,000 tons less than the preceding year, due to the closing of many small mines and curtailment of production in high cost mines by the larger producers. A rough unofficial estimate places year-end stocks of ore at Indian ports and mines at nearly a half-million tons of all grades. The Indian Government's efforts in late 1958 to stimulate ore trade by abolishing the unpopular export tax in favor of increased rail rates and royalty payments was regarded by producers as too little and too late. Responding to producers' complaints, some freight rates were eased in September 1959 but except for a few private barter deals, little trade was reported in the last three months of 1959. India's State Trading Corp. was increasingly active in the manganese market, and reportedly handled about 50% of the exports of ore and alloys in 1959. An indication of the depressed ore price situation that prevailed in 1959 is reflected in the E&MJ quotations for Indian ore, per ltu of Mn, basis 46-48%, c.i.f. U.S. ports, import duty extra, which were $.915-.965 at the beginning of 1959, and sagged to $.87-.90 in April, where they remained for the rest of the year. It should be made clear that these quotations were nominal. The year-end quote was the lowest since mid-1955. The drop was largely due to the lack of demand but declining ocean freight rates and abolition of the Indian tax contributed.

The USSR was reportedly active in the supply of ore and ferromanganese in the Western European market in 1959. Soviet manganese ore production in 1959 is estimated to be in excess of 5-million tons, but lacking information on grades and details on Soviet bloc requirements, such production figures are of little use in a proper evaluation. Red China's manganese ore production in 1959, which has been estimated at 600,000 tons of all grades by a Bureau of Mines specialist, could account for the Chinese ore offerings reported in the world market in 1959.

As it looks at the beginning of 1960, world oversupply will continue to damp the manganese ore market in the months ahead. A number of observers feel though, that some upturn mainly in higher grade ores could develop in the latter part of the year if the high level of activity forecast for the steel industry is borne out. As of now, however, buyers have adopted a wait and see attitude. Any upward movement in ocean freight rates, as some factors predict, is expected to be reflected in a general rise in delivered ore price. END

U.S. Yearly Consumption of Manganese Ore and Consumers'* Stocks (At year end)



*Including stocks in bonded warehouses

Source: USBM Minerals Yearbook

FERROALLOYS

Chrome

Dr. John M. Warde
Union Carbide Ore Co.

THE ORE OUTLOOK in 1960 is for a generally higher level of consumption than that recorded in 1959, if the optimistic estimates of world steel output materialize.

Chrome ore usage is closely associated with steel. About 60% of all chrome ore consumed in the U.S. is currently converted to ferrochrome and chrome metal used for alloying purposes mainly in stainless and heat resistant steels; about 30% is used for refractories, chiefly for the construction and maintenance of open hearth furnaces, and the remainder goes into chemical production.

Metallurgical demand in 1960 could show considerable improvement if stainless steel output—forecast by some observers to increase 15% or more over the 1959 level in the U.S. and 10% and upward in other producing countries—grows as anticipated. Refractory requirements could also increase substantially if the higher operating rates predicted for steel production in the months ahead are realized. Greater use of chrome-containing refractories per ton of steel is also anticipated. Chemical demand, less subject to the cyclic swings that characterize the steel associated usage, is expected to remain at or near the 1959 level.

U. S. Chrome Ore

(Thousand short tons)

	1959 estimate	1958*	1957*
Imports.....	**1,500**	1,263	2,282
Production...	**105**	143	166
Consumption..	**1,315**	1,221	1,760
Metallurgical	**785**	778	1,177
Refractory..	**370**	312	435
Chemical...	**160**	131	148
Stocks, end...	**1,500**	1,536	1,619

*Source: U. S. Bureau of Mines.

1959 was another trying year for the ore market. Freely available supplies and disappointing demand, due mainly to the prolonged U.S. steel strike, were reflected in a slump in ore prices. Strike threats had an adverse effect on the ore market earlier in the year and fear of resumption of work stoppage as the year ended again made buyers cautious. As 1960 began, however, indications were for some upturn in the ore trade as buyers were said to be showing more interest in forward supplies. The chrome consuming countries were reported to have begun the year with ample ore inventories which must be reduced before buyer interest picks up appreciably. On the basis of 1958 consumption rates, U.S. consumer inventories of chrome ore at the beginning of 1960 were estimated to be equivalent to an 11-12 month supply for metallurgical use, two years' supply for refractories manufacture and about 16-month supply for chemical production.

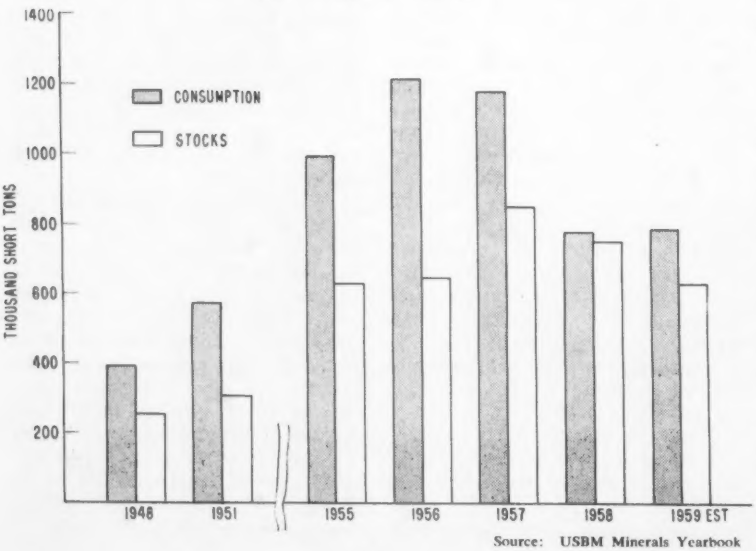
Supplies of chrome ore should be easily available again in 1960. Turkey, a principal U.S. source of chrome ore for metallurgical use, is expected to take a more permanent role in world supply after a difficult year in 1959. Turkey's competitive position was considerably improved as a result of the Turkish Government's action to increase the export premium, effective May 6, 1959, giving chrome exporters an exchange of nine Turkish Lira to the $1 instead of 4.9 TL which had been effective since August 1958.

A post-World War II development which could have a far reaching effect on the long term ore supply picture is the growing interest being shown in the U.S. metallurgical and refractories industries in the less expensive lower grade. Transvaal ores, at one time used only in the manufacture of chromium chemicals. These ores are finding application in the manufacture of cheaper alloys, lower in chrome, now acceptable in stainless steel production as a result of new technologies. They are also being used in increasing amounts in the production of furnace maintenance coatings, mortars and other refractory "specialties." While not presently used for brick making because of technical problems, much research and development activity has been focused on them in recent years by U.S. brick makers looking for new long term supply sources.

Barter is again expected to play a role in the 1960 chrome market. While no deals have been announced, rumors are active. In 1959, Government barter transactions involving U.S.-owned agricultural products for ferrochrome in Western Europe, South Africa and Japan, were claimed to have had a stabilizing effect on the European chrome market. All ferrochrome reserved in the Government's barter program is locked up in the U.S. stockpile.

The removal through barter of large quantities of ferrochrome from the European market, coupled with reduced supplies from some Continental producers owing to a drought-caused shortage of hydro-power late in 1959, resulted in a temporarily

U.S. Yearly Consumption of Metallurgical Chrome Ore and Consumers' Stocks (At Year end)



Source: USBM Minerals Yearbook

tightened ferrochrome market in Europe and some firming in price there. Other developments in the foreign field include the announcement of the plans of Japanese producers to step up ferrochrome output in 1960 to meet the expanding needs of the local stainless steel industry and provide for an export drive, and India's indicated interest in establishing a domestic ferrochrome industry by granting licenses to three parties in 1959 for local manufacture of 23,500 tons of ferrochrome annually; no date has been reported for initial output. Turkey's proposed ferrochrome plant at Antalya, an Eti Bank-Pechiney venture was said to have not advanced past the planning stage.

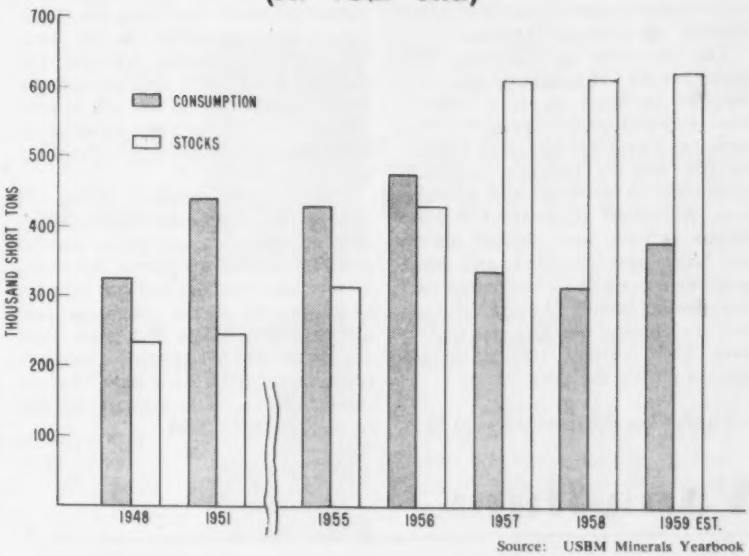
U.S. consumption of chrome ore in 1959 was probably about 8% higher than in 1958 despite curtailed production of alloys and refractories as a result of the prolonged steel strike.

The only domestic chrome ore production reported in 1959 was the American Chrome Co.'s operation at Nye, Mont., from which virtually the entire output was delivered to the Government on contract. American Chrome was reported to have operated a small electric furnace pilot plant at Nye in 1959 to evaluate the feasibility of producing ferrochrome from its ore, and plans were announced during the year to expand output to 25 tpd and add sintering facilities.

In the first 11 months of 1959, U.S. imports of chrome ore for metallurgical use came mainly from Southern Rhodesia, which furnished about half the total receipts and over twice the quantity received from Turkey during the period. The great bulk of the ore for refractories production continued to come from Masinloc in the Philippines, but substantial quantities were also received from the Union of South Africa mainly for use in furnace maintenance coatings. The Union was the only reported supplier of ore to the chemical industry.

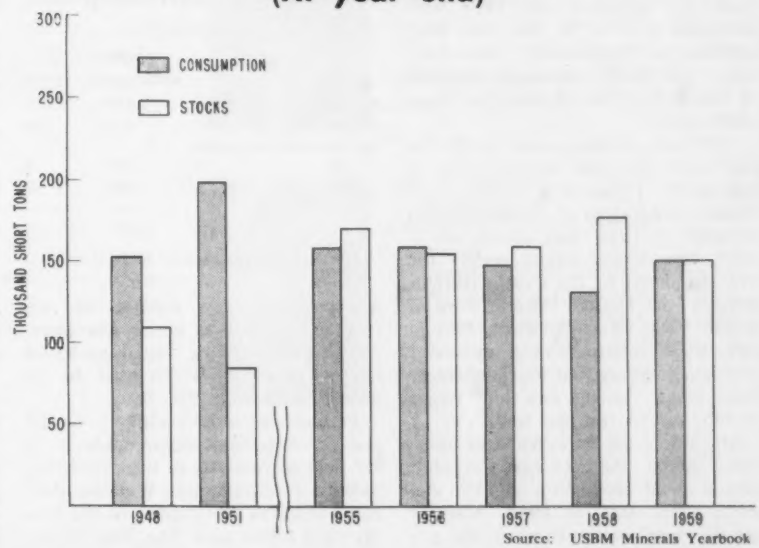
In the foreign mining sector in 1959, accumulation of sizable stocks at mines and ports had a depressing effect on the output of a number of leading suppliers. Turkish producers were again reported to have been particularly hard hit by lack of demand. Many small producers closed down in 1959 and output at the larger mines was at a reduced rate. The new currency premium announced in May permitted a price decrease which resulted in a sizable jump in exports in the third quarter which was reported to be slightly more than the quantity shipped in the entire first half. Despite this increased level of activity, however, shipments at the end of nine months (totaling about 234,000 tons) were still 44% below the comparable 1958 total. Production in Southern Rhodesia was estimated at about half a million tons for the year compared with 619,000 tons in 1958. Indications are that mine production in the Union of South Africa was also at a lower level than in 1958. A new company, Rustenberg Chrome Ores Ltd., was reported to have been formed in South Africa to supply ore to the West German Chemical combine, Farben-Fabriken Bayer, A. G., and its Brazilian subsidiary in Rio de Janiero. It was also announced that Allied Chemical Corp., a leading U.S. producer of chrome chemicals, acquired 51% of the shares of Montrose Exploration Co. which operates chro-

U.S. Yearly Consumption of Refractory Chrome Ore and Consumers' Stocks (At Year end)



Source: USBM Minerals Yearbook

U.S. Yearly Consumption of Chemical Chrome Ore and Consumers' Stocks (At year end)



Source: USBM Minerals Yearbook

mines in the Transvaal and will receive its supplies from that source. The Acoje Mine in the Philippines, which normally produces 120,000 tons of metallurgical ore a year, is reported to be expanding its annual production capacity by about 20,000 tons.

The operations at Masinloc, Philippine supplier of refractory ore, were reported to again be at a reduced level. Political activity reduced Cuban output to a post-war low. Iran Chromite Co. and its affiliates continued production in northeast and southern Iran. Additional exploration was reported to have been carried out in the latter area in 1959 and some progress was made in improving port facilities at Bander Abbas. Exploration for chrome ore was reported to have been carried out in North Borneo during the year.

Chrome ore delivered prices in 1959 were the lowest in years due in part to the depressed condition of the ocean freight market. Turkish ore 3:1, 48% Cr_2O_3 is the bellwether of the market. High and low prices as quoted in E&MJ (per long ton, f.o.b. U.S. Atlantic ports) by quarters were: $43.50-$47, 1st quarter; $38-$46, 2nd quarter; $38-$39.50, 3rd quarter and $36-$37, 4th quarter. All prices were nominal and deals were reported to have been concluded below these figures.

Present ample consumer stocks will have to be worked off before a significant upturn in ore prices can be expected. Before the year is out, however, some observers feel ore demand could develop if the optimistic predictions for stainless and crude steel are borne out. A rise in delivered ore price seems indicated if ocean freight rates advance as a number of observers forecast. END

Vanadium

D. P. Eigo
Engineering & Mining Journal

SALES, according to one ferroalloys producer, increased over 1958 with increased activity in the tool steel market. "High-purity vanadium sales," said H. K. Intemann, president of Union Carbide Metals Co., "rose spectacularly."

The most exciting news, both last year and the year before, was in high-purity ("ductile") metal. Vanadium Corporation of America began shipping in 1958, and completed in 1959, one of the largest orders for wrought metal to the Curtiss Wright division of United Aircraft—metal in the form of strip, sheet, tubing, wire, plate and foil. VCA expanded production capacity at its Cambridge, Ohio plant, placing new and larger "bomb" vessels on the line.

Mr. Intemann, in a year-end interview, noted that Union Carbide's ductile metal production in 1959 was seven times that of 1958. Markets for the metal are opening in the nuclear industry, and as melting stock in vacuum-melting special alloys.

Early in 1960, Oregon Metallurgical Corp. announced receipt of a $430,000 contract for production of high-purity (99.8%) metal in which the Government will be the end user.

Consumption of vanadium in alloys and in its chemical forms is rising. New alloys, many developed with the producers own research departments, are providing new avenues of use, in major as well as minor quantities. VCA announced a vanadium-boron alloy at mid-year which used 40- to 45% V and 7- to 9% B.

Vanadium Consumption

(Short tons)

	1959 estimated	1958
Ferrovanadium	1,570	$,022
Oxide	170	69
Ammonium metavanadate	150	88
Others	160	80
	2,050	*1,259

*Actual consumption of 1,399 (USBM).

Perhaps the most exciting potential use for vanadium compounds is in the field of catalysts in the processing industries. Ammonium metavanadate and vanadium pentoxide are the two principal forms used. The great potential lies in the likely use of vanadium as a catalyst in some sort of an automobile exhaust "scrubber," one of the strong recommendations for reduction of air pollution in urban areas. Pentoxide has the edge in this area over several other likely agents.

Research among vanadium producers is continuing in the catalytic field, in improved performance in nuclear operations, in improved alloys for deep-drawing non-aging steels, for a cladding material which would permit vanadium use in structural areas, and purer metal. END

Iron Ore and Steel

(*Continued from p 119*)

all steel strikes during 1959 brought out facts indicating that the U.S. iron ore and steel position in the world may have capped some sort of a peak. Domestic iron ore production which accounted for 37% of the world's total in 1957, has declined to about 20%. National Industrial Conference Board reported in December 1959 that "Soviet Russia replaced the United States as the world's leading producer of iron ore and coal in 1958." Steel imports in the U.S. during the first nine months of 1959 totaled about 3-million tons, higher than any imports in any previous whole year in history. During the same period, exports declined 36% to about 1.3-million tons. Today, about 50 countries have steel industries, compared with only about 25 countries a quarter-century ago, according to Max D. Howell, executive vice president, American Iron and Steel Institute. In the 1960's the total may be 71 nations.

Increasing foreign production, particularly with modern post-war plants, coupled with low labor costs, about one-third of those in the U.S., is responsible for increasing steel imports in the U.S., and dwindling exports. In South America, companies report that heavy machinery can be obtained from Europe at 40 to 50% of the prices set by American manufacturers. To maintain foreign outlets for U.S. equipment, many manufacturing firms are now establishing plants in foreign lands to take advantage of lower manufacturing costs ex-U.S.

On the technological front, engineering firms and steel companies are progressing in the development of economic methods for the direct reduction of iron ores. Important announcements are expected in 1960. The latest has been the proposed plan of Webb & Knapp Strategic Corp. to equip a plant at Clarkdale, Ariz., which will treat a 30-million ton slagpile at a copper smelter to produce steel products and by-products consists of light-weight aggregates, and possibly copper and zinc oxides. (See E&MJ, October 1959, p 130.) Parallel to this development is the effort by oil companies and others to produce hydrogen or other reducing agents economically to make direct reduction feasible. END

Nonmetallics

Charles A. Wight
President
Freeport Sulphur Co.

Sulphur consumption in the U.S. was at record levels; competition for markets tightened. The Lacq gas fields, in France, doubled sulphur output in 1959. p 152

Reginald Rowand
Production Manager
Baroid Div., National Lead Co.

The domestic barite industry showed recovery in 1959 compared with depressed 1958 production. Renewed emphasis on domestic drilling could cause substantial improvement. p 158

William S. Steele
President
American Vermiculite Corp.

Vermiculite tonnage was approximately the same as 1958, with a decline in use for plaster aggregate. Industry research has stepped up. p 149

Robert B. McDougal
Commodity Specialist
U.S. Bureau of Mines

Fluorspar production declined in the U.S. in 1959, to its lowest rate in 20 years. Domestic industry spokesmen are pessimistic for the new year. p 147

Taber de Polo
Commodity Specialist
U.S. Bureau of Mines

Feldspar demand dropped for some uses in 1959, but increased glass production helped hold domestic output close to 1958. p 150

Milford L. Skow
Commodity Specialist
U.S. Bureau of Mines

Mica demand (block and film) was sustained in 1959 by the continued high level of production in the electronic and electrical equipment industries. p 146

Walter A. Rukeyser
Consulting Engineer
Montreal, P.Q.

Asbestos shipments for all grades are estimated at 1-million tons from Canada. For quite a while, at least, . . . a buyer's market will prevail. p 150

Nelson C. White
Vice President
International Minerals & Chemical Corp.

Potash shipments from domestic producers exceeded production for the second year, as industry moved to reduce swollen inventories. Progress slowed in Saskatchewan. p 148

Finn B. Domaas
Assistant Editor
Engineering & Mining Journal

Western phosphate firms see a bright future—with possible coke from local coal deposits. New overseas markets are sought to combat North African competition. p 154

Mica

Milford L. Skow
U.S. Bureau of Mines

THE CONTINUED high level of production of electronic and electrical equipment sustained the 1959 demand for block and film mica near the 1958 level. About 65% of the mica was fabricated for electronic applications. Consumption of splittings, chiefly to produce molding plate and segment plate for electrical insulation, increased about 40%. Reconstituted mica, the paper-like material made from specially delaminated natural scrap mica, again registered moderately increased usage in applications formerly requiring insulation made from splittings. A newly marketed line of stacked-foil capacitors used mica paper as the dielectric.

The strong demand for ground mica continued with sales estimated near the 1958 level of 97,500 short tons. Wet-ground mica continued to capture about 15% of the market and dry-ground mica the other 85%.

The large increase in imports of block and film mica resulted largely from deliveries to the Government under the incentive-type contracts for procurement of strategic mica. Imports of splittings continued near the same level as in 1958. Most of the muscovite sheet mica continued to come from India and nearly all the phlogopite from Madagascar.

Mica Statistics

(Thousands pounds)

	1959 estimated	1958
Imports:		
Block:		
India	**3,130**	1,993
Brazil	**2,350**	1,711
Other	**220**	105
Total	**5,700**	3,809
Film:		
India	**299**	117
Other	**1**	1
Total	**300**	118
Splittings:		
Muscovite	**6,400**	6,901
Phlogopite	**780**	584
Total	**7,180**	7,485
Consumption:		
Muscovite block and film:		
Good Stained or better	**80**	74
Stained	**1,300**	1,286
Lower than Stained	**1,440**	1,488
Total	**2,820**	2,848
Splittings:		
Muscovite	**7,000**	4,982
Phlogopite	**490**	347
Total	**7,490**	5,329

A re-evaluation of defense requirements indicated that procurement of muscovite block and film for the stockpile can be discontinued. By June 30, 1960, GSA will terminate all its contracts for the purchase of mica from foreign sources.

Production of muscovite block, film, and hand-cobbed mica under the Government domestic mica purchase program continued at a high level. Maintenance of this level of activity is likely and will result in filling the quota—the equivalent of 25,000 short tons of hand-cobbed mica—before the scheduled expiration date of the program, June 30, 1962. By the end of 1959, an estimated 19,500 short tons had been accepted toward the quota.

During 1959, all remaining contracts for financial assistance in exploration for strategic mica under the former DMEA program were terminated or canceled by the Office of Minerals Exploration (OME). Of the 297 contracts executed under the DMEA program, which began in 1951, eight were canceled. The Government advanced $997,317 on the other 289, which had a face value of $1,670,878, and issued certificates of discovery or development on 68 of the contracts, which had a total value of $507,385. By Oct. 31, 1959, OME had executed four new contracts with a total value of $51,934.

A task group of the American Society for Testing materials developed a test method and calibration in 1959 for measuring the waviness in mica on a newly developed instrument. The instrument, employing an optical method developed by the National Bureau of Standards, was built in prototype for the Government by American Research and Manufacturing Corp., Rockville, Md., in 1958.

Synthetic mica continued to create interest, but no method has been found to produce it in a form that is suitable to substitute for strategic grades and qualities of natural mica. Electronic Mechanics, Inc., Clifton, N.J. and Mycalex Corp. of America, Synthetic Mica Division, W. Caldwell, N.J. continued to produce synthetic mica for use in glass-bonded mica ceramics.

The industry-Government program for development and evaluation of substitutes for strategic natural mica continued research on development of reconstituted synthetic mica sheet suitable for use in electronic applications. The contracts with Mycalex Corp. of America, Synthetic Mica Division, W. Caldwell, N.J.; Sylvania Electric Products Corp., Flushing, N.Y.; the National Bureau of Standards; and the U.S. Bureau of Mines were still in force at the end of 1959. Present accomplishments of the program are a novel method developed by General Electric, Corp., Pittsfield, Mass. for delaminating synthetic mica for reconstitution on a Fourdrinier paper-making machine and information on improving the properties of the reconstituted sheet by heat, pressure, and bonding agents. END

Gypsum

L. P. Larson
U.S. Bureau of Mines

INDICATIONS are that U.S. output of crude gypsum during 1959 will approach the record established in 1955 when 10.7-million tons of crude gypsum were produced.

Outlays for new construction, both private and public, in the U.S. during the first nine months of 1959 totaled $41-billion, 15% more than in the corresponding period of 1958. Nearly all types of private construction put in place exceeded the totals for the same months of last year, the major exception being private industrial buildings, off 23% from the 1958 totals. With the exception of educational building construction (down 6%) nearly all categories of public construction rose above the nine-month total of 1958. Outlays for private and public construction during this period totaled $28.5-billion and $12.5-billion, respectively. The total number of new private and public dwelling units started totaled 1.1-million, 23% greater than for the comparable per-

iod of 1958. The average seasonally adjusted rate was 1,376,000 units. Average construction costs for one family houses started during the first seven months of 1959 were $13,250, about 2% higher than the figure reported for the same period in 1958.

Domestic production of crude gypsum reached a new high during the first nine months of 1959 when production totaled 8.2-million short tons, up 1.3-million tons over the corresponding period of 1958, and 0.2-million tons over the previous record high established in 1956. The quantity of calcined gypsum produced during this 1959 period totaled 7.1-million tons, 18% higher than in 1958 when the production of calcined gypsum totaled 6-million.

Imports of crude gypsum in the first nine months of 1959 reached an all time high of 4.5-million short tons, an increase of 41% over the 2.9-million tons imported during that period of 1958. Of this total, Canada furnished 3.6-million tons, accounting for 80.6% of the total. Other nations exporting crude gypsum to U.S. were Mexico, 508,000 short tons or 11.3%; Jamaica, 316,000 tons or 7.0% and 49,000 tons or 1.1% from deposits in the Windward and Leeward Islands, Italy, and the Dominican Republic. Imports during the year are expected to total about 5.4-million tons accounting for 34% of the apparent crude supply.

Several new plants and mines were under construction or placed in operation by gypsum companies during the year. National Gypsum's new ultramodern gypsum products plant at Waukegan, Ill. will manufacture wallboard, lath, plaster, and other gypsum building products for Chicago, Milwaukee, and other construction markets in northern Illinois and Wisconsin. The plant will be supplied with crude gypsum from the company's new northern Michigan mining development at Tawas City, Mich. Capacity of National Gypsum's plant and mine at Shoals, Ind., will be increased 50%. Rock Island Gypsum Co. opened its mine at Weiser, Idaho. Bestwall Gypsum was building a $7-million gypsum products plant at Brunswick, Ga., and a processing plant at Blue Rapids, Kan. The Brunswick, Ga., unit will increase the company's gypsum board production by 36%. United States Gypsum Co. started a mine and plant at Sperry, Iowa, and a $12-million gypsum products plant at Galena Park, Tex.

Outlook for the industry is for further growth. During 1959, several companies announced plans for the construction of new mines, plants, and additions to existing facilities. Kaiser Gypsum Co., Inc., plans to construct a multimillion dollar plant near Albuquerque, N.M. Scheduled for completion in June 1960, the plant will have a rated capacity of 120-million sq ft of gypsum board annually. Bestwall Gypsum Co. of Ardmore, Pa., the nation's third largest producer, plans to add a 16,000 sq ft, $500,000 extension for the manufacture of gypsum acoustical ceiling tile to the $7-million dollar gypsum board, lath, and plaster plant presently under construction at Brunswick, Ga. A $7-million Wilmington, Del., plant approved earlier in the year is in the engineering stage. American Gypsum Co. plans construction of a $3-million gypsum products plant near Albuquerque, N.M. Three new plants will be built by National Gypsum, one in California, opening the west coast to the company's products, and two in Canada. Coverage of the Great Lakes by the company will be complete when their Lorain, Ohio, plant is completed early in 1960. END

Fluorspar Statistics

(Short tons)

	1959 estimated	1958
Domestic shipments:		
Acid grade	115,700	191,800
Ceramic grade	27,600	22,800
Metallurgical grade[1]	33,600	104,900
Total	178,900	319,500
Imports for consumption:[1]		
Containing more than 97% CaF_2	324,700	267,800
Containing not more than 97% CaF_2	203,000	124,400
Total	527,700	392,200
Domestic consumption:[2]		
Hydrofluoric acid	326,600	258,900
Glass and enamel	37,300	34,800
Steel	174,200	174,500
Iron foundry	14,000	12,900
Other	19,400	13,100
Total	571,500	484,200

[1] Includes Government purchases.
[2] Excludes Government purchases.

Fluorspar

Robert B. McDougal
U.S. Bureau of Mines

U.S. PRODUCTION continued to decline in 1959. Output was at its lowest rate in over 20 years, about 180,000 short tons, whereas fluorspar imports and consumption increased substantially over 1958. Government purchase programs which had sustained the volume of domestic output in 1958 had been completed. As imported fluorspar continued to make inroads in the consuming industries, several fluorspar producers ceased operations. In April legislation was introduced in the Senate aimed at curbing fluorspar importation. The fluorspar "Sugar Bill" would have divided the U.S. market between domestic and foreign producers in accordance with yearly estimates of the nation's requirements. This fluorspar quota bill was referred to the Senate Finance Committee and was not enacted.

The Director of OCDM on Sept. 25 announced his finding that fluorspar imports are not threatening to impair the national security. His study was made in response to a petition filed in October 1958 by the American Fluorspar Producers Assn. under Section 8 of the 1958 Trade Agreement Extension Act.

Pursuant to a Senate Finance Committee resolution, the Tariff Commission began an investigation of the fluorspar industry under authority contained in Section 332 of the Tariff Act of 1930. Public hearings began Dec. 15 and the Commission was scheduled to file a supplemental report to Congress before Feb. 29, 1960, updating the 1955 report.

Production in Illinois, 28% below 1958, was approximately 60% of the entire domestic output in 1959. No production was reported from Arizona and California, and production in Colorado, Kentucky, Montana, Nevada, and Utah showed a marked decrease from the previous year.

Following the termination of Public Law 733 on Dec. 31, 1958, several fluorspar producers shut down. Ozark-Mahoning Mining Co. closed its Jamestown mines and mill at the end of 1958 and its Northgate mine and mill early in 1959, leaving as the remaining major producer in Colorado the General Chemical Division of Allied Chemical & Dye Corp. near Jamestown. In operation little more

than a year, the Southern Illinois Mining Co. at Rosiclare, Ill., closed its mill and sold most of the equipment early in 1959.

Metallurgical-grade fluorspar was produced in New Mexico under contract to GSA. Following a fire in the crushing and screening section of its Rosiclare, Ill., mill, Ozark-Mahoning closed the mill for about one month to replace damaged equipment. Lack of demand caused the company to close its mines and mill for one week in September. Minerva Oil Co. operated its two mills at Cave in Rock and Elizabethtown, Ill., on an alternate schedule late in the year.

Prices, which had been bolstered since July 1956 by the Government's purchase programs for domestic fluorspar, began to drop. Domestic producers reduced the price of acid-grade fluorspar to $49 per ton in April. At mid-year the price in contract quantities was quoted at $45. The price of ceramic-grade fluorspar, which competes with imported acid-grade spar in the glass and enamel industries, was reduced $1 to $2 per ton. No price changes were reported during the year on metallurgical-grade fluorspar. On the other hand, metallurgical-grade fluorspar from Europe and Mexico increased on an average from $1 to $2.50 per ton.

Fluorspar imported for consumption was up 35% from 1958, reflecting an upsurge in the business economy following its setback of 1957-58. Imports, including material purchased by the Government, totaled nearly 528,000 tons during 1959 and were valued at about $13-million.

Consumption increased to about 572,000 tons, a gain of 16% over 1958. An increase of 26% in the production of hydrofluoric acid in 1959 was shown in the continued rise in aluminum production and the requirements of synthetic cryolite and aluminum fluoride, and in fluorinated hydrocarbons. Steel plants consumed about the same amount of fluorspar in 1959 as in the previous year despite a lengthy steel strike. An estimated average of 4 lb of fluorspar was consumed per short ton of basic open-hearth steel produced in 1959.

At the year end spokesmen for the domestic industry were pessimistic regarding the outlook for improvement in 1960. END

Potash

Nelson C. White
International Minerals & Chemical Corp.

FOR THE SECOND consecutive year, shipments by domestic potash producers exceeded production as the industry continued the program begun in 1958 to bring swollen inventories to more satisfactory levels. The upward surge in shipments which marked the last quarter of 1958 over the same period of 1957 continued through the balance of the 1958-59 fertilizer year ending in June 1959, so substantial corrections had been made by that time. Gains in deliveries for the last half-year over 1958 were less impressive, but provided an opportunity to push production rates up without building stocks. By the end of the year most plants were operating at close to capacity and in spite of scheduled reductions from vacation shutdowns and some curtailment during the slack summer months, the industry output rose 9% over 1958 to establish a record high. This re-established the growth pattern in which production had increased every year until 1958. Shipments have always registered gains over previous periods.

Tonnage produced in 1959 was approximately 2.35-million tons K_2O, or nearly 4-million tons of product, an increase of 200,000 tons K_2O over the 1958 total of 2.15-million. Deliveries totalled 2.5-million tons K_2O, up 7% from the 1958 figure of 2.34-million. Inventory reduction was, therefore, 150,000 K_2O tons, or over a quarter million tons of product. Deliveries increased to all segments of the market. Domestic shipments for use in agriculture were up 5%, shipments to industry (5% of total) jumped 14% and exports were up 18%. Imports rose 14% to equal exports at 0.27-million tons K_2O. Domestic use and domestic production were, therefore, in balance. Most imported material came from France to West Germany with small tonnages from Russia and Spain. East Germany dropped out of the U.S. market.

Approximately two-thirds of export tonnage was shipped to Japan, the balance scattered throughout the rest of the Free World. Four of the seven producers holding memberships in the Potash Export Association resigned on June 30. Two withdrew from the export market, the other two arranged to sell independently.

The new production record was achieved without any additions to capacity and without anything like full use of available facilities, except for relatively short periods. A further increase of 30% could be obtained without straining present plant. Instead of capacity, the industry continued to concentrate on the two major problems it has faced for the last two years. These are the cost-price squeeze and the demand for different and more uniform physical specifications for its products. As in most industries, the costs of things purchased has continued to rise.

Labor costs rose at mid-year under the terms of the two-year contract in effect. Prices, however, remained unchanged under terms of contracts signed in 1958 which established a ceiling until mid-1960. Pressure on costs was aggravated by the increasing demand for sized products. The industry sold the bulk of its tonnage for years as "standard" material, fine crystals ranging in size from 20 to 200 mesh. A small fraction was sold as "granular" in a 6 to 20 mesh range. The advent and growth in demand for granular fertilizers led many small fertilizer manufacturers into process equipment which worked best when supplied with coarse particles of potash to act as seeds for the fertilizer granules. The demand for this type of material has grown steadily over the last five years and has been supplemented in the last three by increasing demands for a granular product.

This stems from growth of so-called "bulk-blending" in which three forms of basic fertilizer materials (nitrogen, phosphate and potash) are physically mixed to desired proportions. This requires relatively equal and uniform sized materials approximating the granules produced in fertilizer granulating units. The industry is now called on for three sizes, each as uniform as possible—standard, coarse and granular—with the latter two growing steadily at the expense of the first and already accounting for over half the market. Much, if not most, of this material requires more processing than the standard grade, hence has increased costs without compensating increases in selling price.

Few major changes were made by the industry in seeking better efficiency and physical quality for products.

American Potash at Trona added new crystallization and auxiliary equipment designed to improve both physical and chemical quality. Bonneville reports no changes.

At Carlsbad, all producers but one report no major changes. The exception, National Potash, added a new dryer to dry ore prior to processing (not practiced by other producers) and new desliming, crystallizing, compacting and screening equipment, all designed to improve recoveries and product quality. National also began supplementing their mine production with ore purchased from Southwest Potash which required surface installations for handling this operation at both plants as well as additional mining equipment at Southwest.

Two potential new producers in the States continued active without any announced plans for actual production. Farm Chemical Resources Development Corp. (Kerr-McGee-Phillips-Farmers Union) who completed a shaft near Carlsbad in 1957, are continuing process development work. Delhi-Taylor, who began exploration of the deposit near Moab, Utah, in 1953 continued exploratory drilling for better orebody delineation and process design. Events moved more slowly than expected in the two new Canadian developments at Saskatoon and Esterhazy, Saskatchewan. Potash Company of America, Ltd. began break-in operations of their mine and refinery in December 1958. Unusual difficulties were encountered and these were aggravated in midsummer by water leakage in the shaft. As leakage increased, the company decided to suspend operations until corrections were made. Cementations, Ltd. is now working on a grouting program to seal off the water. IMC of Canada had completed their shaft to 1200 ft, at which point it was just above a bad sand and water zone. An attempt was made to stabilize the ground with cement and chemical grouting but the results were not satisfactory and the company decided to freeze the zone. A station was built at the 1200 ft level and freeze pipes run into limestone 250 ft below. Freezing began in late summer and was continued for the balance of the year, at which time it was essentially complete. Another year is required to complete sinking. Surface construction was slowed to meet the new shaft schedule.

The continuing increased demand for product is the most encouraging development the industry has seen for several years. The beginning, in late 1958, had to be discounted because it coincided with new price schedules offering reductions in the off-season. Its continuation indicates a return to the expected 4- to 5% increase per year after a three-year period of virtually no growth. The new record tonnages produced and sold will not lead to record profits, since prices are pegged at 1937 levels, but the assurance that unused capacity will be needed in the near future should provide the spur needed to improve profits through improved pricing. END

Vermiculite

William S. Steele
American Vermiculite Corp.

THE VERMICULITE INDUSTRY in the U.S. reports an appreciable increase in earnings in all segments for the year 1959, based on a tonnage approximately equal to 1958 figures.

A reduction in tonnage for plaster aggregate has developed because of the lower cost of dry-wall construction in certain areas. The steady rise in interest rates and structural costs have forced many builders to substitute painted plaster board for conventional lath and plaster. Joint campaigns of the allied plastering industries, supported by the contractors and building trades organizations, have been successful in many states in checking this tendency, however.

New uses, new products and an increasing demand for vermiculite in more profitable areas are responsible for this increase in earnings for 1959.

For the past 25 years, the principal markets for exfoliated vermiculite have been home insulation, concrete and plaster aggregate, and vermiculaponics. In each of these markets, dozens of competitive materials have created an unattractive profit condition, so that the producers of vermiculite have been forced to develop new outlets for their products. As a result, all of the research organizations in the industry have been unusually active.

Vermiculite is now used increasingly as a free-pouring insulation fill in masonry wall and spaced-apart wall construction with substantial savings reported. Vermiculite acoustical plastic is now approved as a spray-on, fireproofing protection directly to the lower surface of steel floors in Class 1 buildings. A new vermiculite fireproof coating, "Pyracote," has been awarded a four-hour fire rating by Underwriters' Laboratories. Pyracote, developed for Vermiculite Association, Inc., is a setting material, containing an integral adhesive, applied directly to steel or other smooth surfaces. It requires no preliminary spraying and no tamping, does not bulge, crack or dust off and is wholly non-combustible.

A recent fire test produced a four-hour rating for "Pyro-Coustic," its proprietary fire-protective coating ¾-in. thick sprayed directly to a Fenestra smooth steel deck.

Finely divided exfoliated vermiculite is prominently used as an insulant at cryogenic temperatures—a rapidly developing field.

Crude, carefully screened, South African vermiculite, after years of service abroad, is now being tested as a medium for the removal of radioactive wastes in effluent solutions.

As a carrier of active chemicals in pesticides, chelates, mosquito control dusts, crab grass inhibitors, etc., exfoliated vermiculite is being used increasingly. Its high absorptive capacity and its ability to release its chemicals repeatedly are characteristics necessary for the functioning of these materials. Vermiculite is also being used as a soil conditioner; for soilless plant growth; for floral arrangements; and as a filler in commercial fertilizers to prevent caking and sack-setting.

Vermiculite concrete is now pumped and sprayed over corrugated metal roof decks both as an insulant and as a base for built-up roofing. Treated vermiculite nuggets, packed in small units for home use, are being introduced as a fire-starting base for charcoal grills.

The product is also rapidly replacing popcorn and other organic materials for packaging. Particular attention is now given to the development of prefabricated curtain walls.

Research programs of the industry for 1960 have been accelerated. The Vermiculite Association, Inc., Mandoval Research of London, and Transvaal Ore Co. Research, Johannesburg, at a joint meeting in London in July 1959, developed a worldwide program allocating various research phases to each, to be jointly reported. Vermiculite Institute also reports a stepped-up program for 1960.

New sources of crude vermiculite throughout the world continue to be reported, but none of commercial importance have been proved to date. Zonolite mines in Montana and South Carolina, and the Phalaborwa deposit of Transvaal Ore Co. Ltd. in South Africa, (North and South America representative—American Vermiculite Corp.) continue to supply 98% of world consumption. A slow but steady growth is predicted for the year 1960, estimated at approximately 210,000 tons for the U.S. and Canada. END

Feldspar

Taber de Polo
U.S. Bureau of Mines

ALTHOUGH demand for feldspar for some uses declined in 1959, requirements for increased production of container glass and flat glass kept total production close to the 1958 tonnage figure (469,738 long tons). Excess production capacity and continued competition from substitutes resulted in a drop in the price of glass-grade feldspar for the third successive year, from $9.80 to a low of $9.00 per short ton f.o.b. purchase plants in the North Carolina area.

Feldspar milling capacity was increased in 1959 by the construction of a plant at Pacolet, S.C., by Paco Products Corp. This plant is near the large granite quarry of the Campbell Lime and Stone Co. from which the screenings of the crushing and grinding plant are treated by flotation. High-quality feldspar, ground silica, and a combination of silica and feldspar are the saleable products. Glass companies at other locations obtained some of their feldspar requirements from similar feldspar-silica sand deposits.

The percentage of feldspar produced by flotation continued to increase. Feldspar Corp., producer of approximately one-third of the nation's feldspar, announced plans to construct a modern flotation plant in Middletown, Conn. The plant will produce both glass and pottery-grade feldspar, and mica and silica.

Imports of crude feldspar from U.S. controlled companies in Canada remained about the same as in 1958. Imports from Canada of nepheline syenite, the principal substitute for feldspar, continued at the same high level as in 1957.

Production of aplite for use in making amber glass and window glass increased about 15% in 1959 from 1958. All aplite production was from Virginia. END

Asbestos

Walter A. Rukeyser
Consulting Engineer

THE PAST YEAR saw greater industry emphasis on modernization and improved treatment of asbestos rock in North America and abroad. Shipments of all grades for 1959 are estimated at 1-million tons from Canada.

In recent reviews, the author has attempted to ascertain whether or not a definite relationship existed between Canadian shipments and the U.S. gross national product. It now appears, from a study of the pertinent statistics of the past 10 years, that no such relationship does, in fact, exist.

The above estimate of 1-million tons is based upon Dominion Bureau of Statistics (Ottawa) figures for the first nine months (757,287 tons). For 1957, the tonnage shipped was 1,046,086 when the GNP was $433-billion. In 1958, the GNP rose to $436-billion, but asbestos shipments declined between 11- and 12%. In 1959, when GNP reached an all-time high of $480-billion, shipments from the Dominion will have barely reached pre-recession levels. And this despite a 1959 record for new-home starts (over 1.3-million units) and a total construction expenditure which will probably surpass $70-billion for the first time in history.

Canadian Asbestos Exports

(Short tons)

	September		9 months	
	1959	1958	**1959**	1958
Crude	**32**	43	**278**	358
Milled fibers	**41,367**	27,192	**275,336**	218,064
Waste, refuse, shorts	**54,327**	53,613	**454,147**	392,248
Total	**95,726**	80,848	**729,761**	610,670

Canadian Asbestos Shipments (1950-59)

(In tons)

1950	875,344
1951	973,198
1952	929,339
1953	911,226
1954	924,116
1955	1,063,802
1956	1,014,249
1957	1,046,086
1958	925,331
1959	1,000,000 (est)

The annual average of the above table comes to approximately 966,000 tons, a figure only slightly under the estimate for 1959, a record-breaking year. And, during that same decade, Canada's milling potential has been doubled; from 31- to 32,000 tpd of rock to the present whopping 63,500.

1959 World Production

(Estimated—short tons)

United States	45,000
South America	19,000
USSR	600,000
Balance of Europe	80,000
Asia (includes Cyprus)	47,000
Africa	360,000
Australia	15,000
	1,166,000
Canada	1,000,000
World production	2,166,000

Quebec's shipments during the first nine months of 1959, saw the crudes continue to lose ground and spinning fibers recover 17.33% of the one-third lost during the year 1958. Shingle stocks regained 13.8%, compared to the previous loss of more than one-fourth, reflecting the trend toward increasing use of shorter grades in manufacture of asbestos cement products. Group 5 and 6 fibers recovered 27.4- and 26.3% respectively against the previous year's loss

Canadian Asbestos Shipments by Grades

(Short tons)

Grade	Shipments (including own use)			
	September		9 months	
	1959	1958	**1959**	1958
Quebec				
Crude—No. 1, No. 2, Other	**3**	25	**256**	398
Milled—Group 3 (Spinning)	**2,054**	1,851	**16,114**	13,790
Group 4 (Shingle)	**25,081**	14,705	**136,708**	120,164
Group 5 (Paper)	**11,575**	11,782	**86,047**	67,523
Group 6 (Stucco)	**10,025**	13,304	**121,606**	96,269
Group 7 (Refuse)	**42,663**	41,650	**340,120**	307,291
Group 8 (Sand)	**1,452**	1,074	**12,217**	13,369
Total all grades	**92,853**	84,391	**713,068**	618,804
Canada (Quebec, Ontario, B. C.)	**98,363**	88,992	**757,287**	657,086

of less than one-eighth and one-fifth, further reflecting the trend. Lastly, Group 7, of which floor-tile fibers represent the bulk of usage, recovered 11% against a previous loss of about one-ninth.

Refuse and shorts comprised slightly more than 62% of the total shipped for the nine months of 1959; for the same period in 1958, it was 64%. Milled fibers for the first three-quarters of 1959 were up 26% plus and shorts, etc. only 16%. In this connection, it must be noted that the 60,000 tons estimated for Ontario and British Columbia (Cassiar) consist wholly of asbestos cement and spinning grades, a fact that may partially explain the small proportionate rise in shingle fiber in Quebec.

The recession of 1958 deprived Canadian production costs of much of their meaning. With slightly over 12% less fiber produced, 5% less labor was employed (about 7,000) and costs were down only 4% to produce 12½% less asbestos. Furthermore, the percentage of rock mined to rock milled increased. In 1958, 21,574,610 tons were mined to feed 12,358,444 to the mill for an asbestos production of 925,331 tons. In 1954, 14,793,760 tons of rock provided 11,394,571 tons of mill feed and produced 924,116 tons of fiber.

Since major new projects and additions to production facilities in Quebec were completed by the end of 1958, few if any such developments are to be reported for the year just past. The exception was the completion of the rationalization of the King-Beaver project of Asbestos Corp. The mill has now been completely modernized, its capacity brought to 5,000 tons rock daily, its feed coming jointly from the Beaver open pit (two-thirds) and the King block caving (one-third). A unique feature of the present layout, dictated by the economics of the situation, calls for the utilization of only one crushing plant—that at the old King millsite. Rock from the Beaver is taken to the King where it is crushed with the King rock and the combined product then sent back to the new King-Beaver mill for final treatment.

Asbestos Corp. has thus resolved all its present production facilities into three mills, each rated at some 5,000 tpd (rock), the British-Canadian at Black Lake, the Normandie at Vimy Ridge and the King-Beaver at Thetford Mines.

A second important news item came out of Quebec during the year.

Johns-Manville in August announced its decision to abandon block caving at its Jeffrey Mine at Asbestos. This announcement practically coincided with the company's statement that open pit mining at their Munro (Ontario) mine had been terminated and that the entire mill-feed was now coming from underground. Relative to the decision to restore open pit mining at Asbestos on a 100% basis there appeared a published statement in detail as to the why's and wherefore's of the move. It is believed worthwhile to reproduce this statement in this review.*

"Due to rising labor and material costs, underground mining operations have now become uneconomical as compared to open pit mining. Therefore, Canadian Johns-Manville Ltd. has decided to expand its open pit operations, and in three years' time underground operations will be abandoned. Open pit mining also allows better selection of ore for the mill. Open pit ore is drier and therefore requires less drying. These operations cost less than underground mining. They also allow for a better selection of the mineral, and faster and more economical method of drying.

"Improvements in design and equipment for open pit mining will change the mining picture at Jeffrey Mine. The changes have resulted in the decision to enlarge open pit production capacity from the present 12,000 tpd to a potential of 30,000 tpd of ore and 12,000 tpd of waste.

"The result of the program will be the eventual closing of the underground mine. However, normal turnover of man-power and increasing man-power requirements in the open pit should not affect the present labor force to any great extent.

"The program is scheduled for completion in approximately three years and involves several changes and additions to present open pit procedures.

"1. Further overburden stripping and waste rock mining as required, since it is necessary to enlarge the open pit on the upper levels to allow ore mining on the deeper levels.

"2. A system to complement truck haulage will be used, since the limit at which truck haulage, alone, is most economical, has been reached. The system to be used is an inclined skipway of which there will be two: one for ore and one for waste, each of 35-ton capacity.

"To allow for ore mining at deeper levels, the rim of the pit will be enlarged and will require stripping of the overburden.

"It will be necessary to strip approximately 8-million cubic yards of overburden in addition to the 4-million that is presently being removed.

"Since the final pit wall will be maintained at an angle of 45°, it is necessary to mine waste rock below the overburden to provide for the opening of ore reserves on the levels below. The waste rock mined in this operation will be trucked to the waste skipway, hoisted to surface, loaded into rail cars, and disposed of at the Elliott dump."

35-ton trucks will take ore from the skip.

In British Columbia, 1959 saw that province's only producer, the now justly famous Cassiar, continuing at capacity and enlarging its ore reserves. The company's earnings for 1958 counters the recession trend general throughout the rest of the industry and its net profit of $2,897,473 for '58 represented over $7.00 per ton of rock milled. This amount is almost as much as the gross value per ton average as milled in Canada (12.3-million tons having produced some $92.3-million in fiber sales).

* "Asbestos", August 1959

Prospecting for and development of new properties in B.C. continues at a steady pace. Cassiar alone is exploring several major claim groups and in one in particular in the Yukon it is said to have some 5-million tons of high grade ore developed to a depth of only some 50 ft below the adit level.

In Newfoundland, development of Advocate's orebodies continues under the aegis of Johns-Manville; and British-Newfoundland Corp. is working in conjunction with both J-M and Asbestos Corp. The partially explored territory in the Lewis Hills near Port-au-Port on the southwest coast of the island is again receiving attention. Fiber of excellent length and quality was developed there in 1951 and prior years.

In Arizona, Jaquays Mining erected a new mill to produce some 10 tons of fiber daily from its Regal Mine. The crude section of the mill treats two tons of ore per hour.

In Calaveras County, California, American Asbestos (Robins Corp.) appears still to be exploring the possibility of erecting a mill to supply the asbestos-cement and floor tile industries of the West Coast.

Elsewhere in the Free World not much news has been reported. Mergers and company purchases are being effected (e.g. Cape Asbestos's corporate purchases in South Africa). The industry everywhere, but particularly in Canada, is striving for rationalization of mining and milling methods, for extremely clean and uniform fiber production, for lowered costs, increased mechanization—even automation.

For quite a while at least it looks as though a buyers' market will prevail and even the most optimistic do not believe potential mill capacity will be utilized to its maximum until possibly the middle of the decade ahead.

The nineteen fifties saw the asbestos industry throughout the world, and particularly in Canada, progress by leaps and bounds into new mines, new mills, new companies. The result has been a tightening of competition, a spreading of markets among a greater number of producers and a greatly, if not inordinately, expanded production. Thus the closing months of 1959 saw all classes of fiber in superabundant supply, despite a banner year in the world's economy—the only exception being in the Grade 7-R, where Quebec, for all practical purposes, continues to be the sole producer. END

Sulphur

Charles A. Wight
Freeport Sulphur Co.

THE YEAR 1959 was marked by record sulphur consumption in the U.S., high exports and imports and increased competition for markets.

Domestic use of sulphur in all forms, according to preliminary estimates, was about 6-million long tons, an increase of better than 10% over 1958 and some 200,000 tons over the previous record established in 1956.

The new consumption record was reached despite the lessened demand from the strike-bound steel industry, normally a major consumer accounting for about 7% of total use. The loss in steel was more than offset by the excellent business enjoyed by such other large consuming industries as fertilizers, chemicals, pulp and paper, pigments, and rayon.

The demand for U.S. sulphur abroad also increased despite the growing competition from numerous new foreign sulphur-producing plants. Exports are estimated to have exceeded 1.6-million long tons, and final figures may show the total to be above the record 1,651,000 shipped in 1956. The major importing countries in their order of volume are Canada, the United Kingdom, Brazil, India, and Australia.

Domestic sulphur production was up slightly in 1959. Output from all sources amounted to an estimated 6,225,000 tons, compared with 6,140,000 tons in the previous year. This supply was augmented by 600,000 tons from Frasch stockpiles which producers cut back from 4-million tons to about 3.4-million tons.

Of the total production, an estimated 4,525,000 tons were elemental sulphur mined by the Frasch hot-water process from salt dome deposits located along the coast of Louisiana and Texas. Of the balance of the output, 740,000 tons represented elemental sulphur recovered from refinery gases and sour natural gas; 450,000 tons sulphur contained in pyrites; and 510,000 tons sulphur in various forms from other sources.

Imports of sulphur, although at a high level, failed to maintain the sharply rising trend begun in 1955 with the development of Frasch-process mines in Mexico. Total imports—including more than 600,000 tons of Frasch from Mexico, recovered sulphur and the sulphur content of pyrites from Canada—about equaled the 755,000 tons shipped in 1958.

Twelve Frasch-process mines operated on the Gulf Coast during the year. In December, however, Freeport's Bay Ste. Elaine mine, located south of Houma, La., was closed due to exhaustion of reserves. Texas Gulf Sulphur Co. and Freeport Sulphur Co. remained the largest producers, followed by Jefferson Lake Sulphur Co. and Duval Sulphur and Potash Co.

One new mine was nearing com-

U.S. Sulphur Production

(Thousands of long tons)

	1959 estimated	1958*
Frasch	4,525	4,645
Other elemental Recovered	740	640
Other native	35	2
Sulphur in pyrites	450	403
Sulphur in gases	475	450
Total	6,225	6,140

*U. S. Bureau of Mines.

U.S. Sulphur Recovery Projects Completed or Under Construction in 1959

(Long tons)

	Estimated annual capacity	Gas source
Allied Chemical Co. Richmond, Calif.	35,000	Refinery
Anlin Co. Wood River, Ill.	52,000	Refinery
Calif. Mex. Oil & Ref. Co. San Diego, Calif.	NA	Refinery
Consol. Chem. Co. Baytown, Tex.	21,000*	Refinery
Gulf Oil Co. Atacosa, Tex.	26,000	Natural
Hancock Chemical Co. Wilmington, Calif.	52,500*	Refinery
Pan American Petroleum Co. Empire Field, N. M.	5,000	Natural
Sun Oil Co. Toledo, Ohio	4,000	Refinery
Tidewater Oil Co. Smackover, Tex.	78,000	Natural
Total	273,500	

*New capacity at existing plants.

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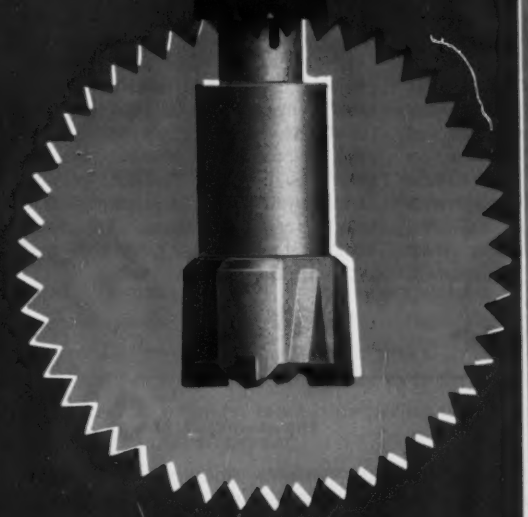

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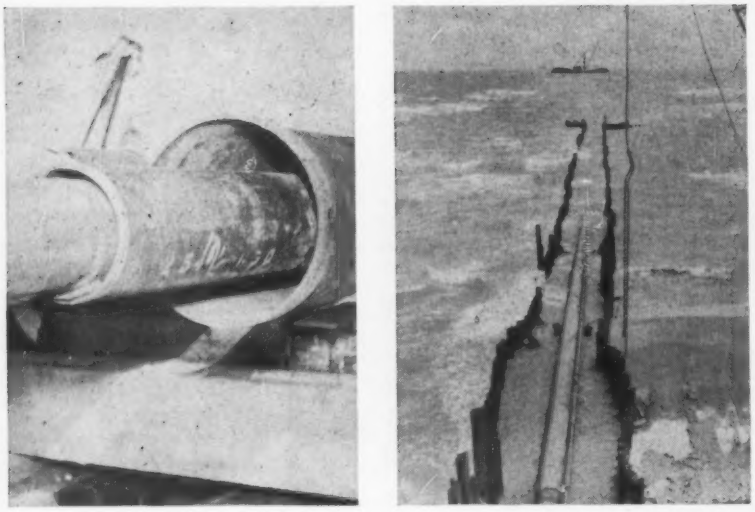

HISTORY-MAKING TECHNOLOGY occurred in 1959 at Freeport Sulphur's Grand Isle mine, off the coast of Louisiana, when the company successfully strung a seven-mile pipeline from the first offshore sulphur mine to land to handle molten sulphur.

pletion with start-up scheduled for the first half of 1960. This is Freeport's Grand Isle project, the world's first offshore sulphur mine, situated seven miles off the shore of Louisiana in 50 ft of water. Installation of boilers, pumps and other equipment was being made on the steel structure which, when completed, will stretch for nearly one mile across the water.

One of the several unique features of this mine is the heated pipeline, sunk in the bottom of the Gulf, which will carry the liquid sulphur to the Grand Isle land base. The seven-mile line, already completed, is made up of three pipes, one within the other, which are heavily insulated in order to maintain the temperature of the flowing sulphur at no less than 280° F. The innermost 6-in. line, carrying the sulphur, is surrounded by a 7⅝-in. line carrying water at 320° F, which in turn is surrounded by insulation and a 14-in. casing.

The principal problem which the pipeline presented was the thermal stress which would normally cause the inner lines to expand about 55 ft when heated to operating temperature. Expansion joints, or loops, the usual means of providing for such expansion in above-ground lines, were not feasible. Instead, the outer pipe was stretched under 10,000 psi tension and fixed to anchors while in tension and the inner pipes were heated and allowed to expand their normal length. While in this expanded condition, they were fastened to the outer casing. Thus, when the lines are in operation, the thermal stress will be compressive, thereby reducing longitudinal movement to "almost zero."

In Mexico, a fourth Frasch mine, Texas International Sulphur Co.'s project at Texistepec, began limited operation. Total Frasch production was an estimated 1.3-million tons, up 100,000 tons from 1958, while shipments about equaled the 1958 volume of 1.1-million tons.

In Canada, construction of several previously announced sulphur recovery units based on sour natural gas are awaiting the results of governmental hearings on the granting of gas export permits for movement of sweetened gas to the U.S. During the year, however, one new recovery plant was brought into production and four plants were under construction in Alberta. Completed was Texas Gulf Sulphur's Okotoks plant with an annual capacity of 100,000 tons. Facilities under construction were those of Canadian Oil at Innisfail, California Standard et al and British American at Nevis, and Imperial Oil at Nottingham. The announced capacity of the four latter projects totals 100,000 tons.

Several other projects in Canada were under construction during the year. The plants, their sulphur source and estimated annual capacity included the following: Irving Refining, St. Johns, N.B., refinery gas, 4,500 tons; Sherbrooke Metallurgical, Port Maitland, Ont., smelter gas, 45,000 tons; and New Manitoba Mining & Smelting, Winnepeg, Man., nickel concentrates, capacity not announced.

Texas Gulf Sulphur continued pilot-plant work to recover elemental sulphur from International Nickel's iron pellet plant at Copper Cliff, Ont., and Noranda Mines closed, as being uneconomic, its Port Robinson, Ont., plant which produced elemental sulphur, SO_2 gas and iron ore from pyrites.

In Europe, the most important new source of sulphur was the sour natural gas field at Lacq, France. Sulphur production capacity, which was increased to 350,000 tons per year at the end of 1958, was doubled by mid-year 1959. Construction is proceeding with the final stages of the plant, which will increase capacity to 1.4-million tons by year-end of 1960.

Several other sulphur recovery units have been or were being built at petroleum refineries in Europe. These included projects of Shell and Esso oil companies in West Germany at Hamburg and Cologne, respectively.

Elsewhere in the Free World, projects completed, under construction or announced in 1959 were as follows (by country, source and annual capacity): Australia, smelter gas, 29,000 tons; Finland, pyrites, 114,000 tons; Italy, gypsum, 180,000 tons; Norway, pyrites, 13,0 tons; Turkey, smelter gas, 22,000 tons, and gypsum, 15,000 tons. END

Phosphate

Finn B. Domaas
Engineering & Mining Journal

THERE WERE SEVERAL indications during 1959 that, though production in the southeastern states would continue to rise, the western phosphate districts might be the center of rapid growth in the immediate future.

For the western phosphate industry, possibly the most important news came at the end of the year—discovery of methods to carbonize locally mined low-grade soft coal into pellets that can serve as metallurgical-grade coke in electric furnaces to produce elemental phosphor-

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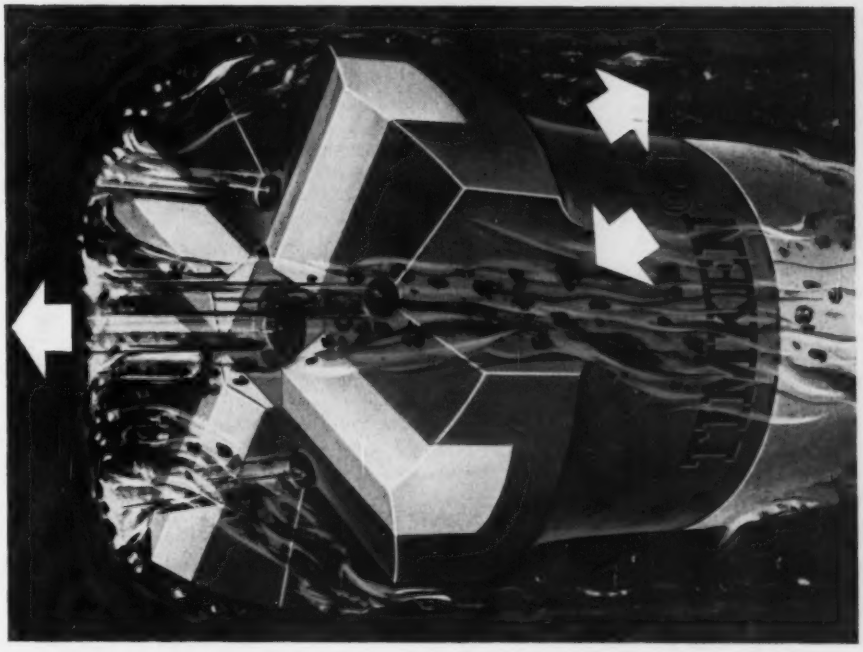

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us. By being able to use their own vast reserve of sub-bituminous brown coal deposits, scattered throughout the Utah-Wyoming Intermountain area, western phosphate firms could virtually free themselves of dependence on coke from Kentucky and West Virginia.

Two firms, Food Machinery & Chemical Corp., and U.S. Fuel Co., have already begun projects to utilize this western-produced coke. Food Machinery & Chemical, through its Mineral Products Div., will build a $3.5-million coking plant at Kemmerer, Wyo. Pellets will go to the firm's phosphorus facility at Pocatello.

U.S. Fuel Co., Salt Lake, has been piloting a process similar to Food Machinery's and may soon build a $2-million plant.

If the West's Intermountain area becomes as great a coke producer as some feel it will, the increase in western phosphate activities might not be just confined to the immediate future. It might very well permit Idaho, Montana, Utah and Wyoming to produce a steadily increasing share of all U.S. phosphate materials during the next decade.

Additional industry developments took place last year in the West and elsewhere. The following are some examples:

Northern Utah became the center of a great deal of interest in phosphate mining as competitive bidding took place at the end of the year. Bids on more than 5,000 acres in the Uinta Mountains opened at Salt Lake City's Federal land office. A reliable source in that region said that, since 1944, the Intermountain West had increased phosphate rock production eight times, while output in the rest of the country had only doubled.

Bunker Hill Co. acquired phosphate lands in western Montana to help supply the triple superphosphate plant that it plans to build this year at Kellogg, Idaho, where the company produces sulphuric acid as a byproduct from its lead and zinc operations.

J. R. Simplot Co. completed a 400-tpd sulphuric acid unit at its Pocatello works, acquired operating rights on Anaconda's phosphate operations at Conda, Idaho, and converted the properties to open pit.

In the southeast, Hooker Chemical and Monsanto Chemical are expanding their phosphorus operation in Tennessee, and American Agricultural Chemical will surely increase its Florida phosphate production this year to supply the $2-million phosphorus products plant that's being built in New Jersey.

Stauffer Chemical Co. merged with Victor Chemical Works to become a major U. S. phosphate producer.

A few of Stauffer's phosphate assets were: important holdings in several widespread western areas; numerous processing plants, 50% ownership of both San Francisco Chemical Co. and Western Phosphates Inc.

Victor's contribution included: phosphorus products that now number in the hundreds; mines in Montana and Tennessee, plus reserves in Florida where the company operates a modern phosphorus reduction furnace; and a program of intensive research on phosphate chemistry.

Direct results of the merger? To Stauffer's 47 mining and chemical plants and 4,530 employees, Victor threw in nine plants and a staff of 2,636 to make a total of 56 plants employing 7,166. Combined total assets of the two firms (Jan. 1, 1959 figures) was $194.7-million while the combined sales volume and earnings for 1959 were an estimated $225-million and $20-million.

Increased ore recovery schemes also played a part in the phosphate news for 1959. The first occurred at AIME's annual meeting in San Francisco where Sylvain Pirson, petroleum engineering professor at the University of Texas, explained a fluid-mining technique for in situ recovery of phosphates. (A patent was taken out for this process in 1958).

Pirson's scheme called for drilling injection and producing wells into a phosphate formation. Sulphur dioxide in water was to be pumped down the injection well and recovered through the production well. It would emerge as a mineral-bearing solution from which high-purity dicalcium phosphate could be extracted.

The Texas professor said that as much as a third of the fine phosphate was lost when sand and clay were removed during normal beneficiation processes. However, with fluid-mining, Pirson added, as much as 80% of the deposit's dicalcium phosphate could be recovered. He went on to say that because the end-product of the operation was in a finely divided state, it could be used to manufacture triple superphosphate and other high-grade phosphate chemicals.

A few estimates of in situ recovery of low-grade phosphates from Florida's Bone Valley went as follows: to get 21,500 tons of dicalcium phosphate over a three-and-a-half-year period would require a fixed investment of $238,000 and operating costs for the same period would be $563,-000. If the product were sold as feed additive, the return on this investment would amount to $4.28 for each dollar put in.

Another ore recovery plan was announced in USBM's Mineral Market Report MMS No. 2925. Bureau director Marling J. Ankeny announced that further tests with the phosphate rock planer in Idaho would continue during the 1960 fiscal year. The study, Ankeny said, is part of a program to increase recovery of phosphate and a related project will cover improved beneficiation methods for both western and southeastern phosphate rock.

Results of tests made up to the time of the Bureau report showed that the planer must undergo slight modification. When the changes are made, experiments will be conducted in an effort to upgrade large tonnages of rock that are now being by-passed.

During 1959, the Bureau was still continuing to determine the chemical and physical makeup of Florida and Tennessee phosphate slime and to develop possible processes for using them. Under present practices, the slow settling slimes (containing nearly as much phosphate as the original ore) are being wasted. Added to this waste is the fact that the 10-million tons discarded annually requires large acreages of high value land for storage.

Foreign markets. Just as the western phosphate firms were experimenting in '59, so were the Florida producers and shippers trying new methods. However, where one group had emphasized technological advances, the other tried new market practices in an effort to increase overseas sales of U.S. phosphate.

In what was a definite move to curb the underselling policies of the North African phosphate dealers, the Florida producers last year refused to act as the base for the North African pricing. H. S. Ten Eyck, president of the International Ore & Fertilizer Corp., said in a recent address at Tampa that "previously, the Florida prices fluctuated only in direct relationship to be varied costs of labor and fuel oil. There is a basic escalator clause that governs the rate of this change. The North African pricing policy was thus based on this more or less fixed attitude towards pricing that the Florida producers had adopted in the past.

"This year (1959), U.S. producers, having secured a firmer grip in the

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European market, were determined to maintain the position. Therefore, when the North Africans lowered their prices in July to compensate for lower freight, the U.S. followed suit on those grades where it was necessary to reduce prices to stay in competition. This is, perhaps, the first time that the American producers have countered the pricing policy of the North Africans with such an action."

Nevertheless, Ten Eyck went on, in South Africa, where the Moroccan rock has been particularly underpriced, the U.S. shipments are, in fact, only token gestures. "The total South African market amounts to 400,000 tons. The U.S. ships approximately 20,000 tons and, based on the current North African price and the freight market, it seems likely that we might even lose part of the 20,000 tons in 1960."

Mr. Ten Eyck then considered phosphate markets in Asia where the North Africans were once again able to continue their unique selling policies.

Practically all of the Florida sales in Asia are limited to Japan. Of that country's 1.6-million-ton total consumption, the U.S. is able to supply a little more than 1-million tons.

As a final statement on the underselling policies, Ten Eyck said that "wherever our geographical position gives us an almost permanent freight advantage, the North Africans are, through their monopolistic sales organization, able to alter the price to fit the particular need."

Next is the question of the Australian market, which Ten Eyck said "is almost completely supplied by Ocean and Naru Islands, with some additional tonnages from Makatea. It is entirely possible that with the decreased production in these areas, along with the increased consumption in Australia and New Zealand, Florida rock may enter those markets within the next five years."

As it now stands, total U.S. exports (2.55-million tons) is broken down in the following manner: roughly 1-million tons goes to Japan; another million tons goes to Europe; and the remainder is shipped to Canada, Latin America, India, etc. Expanding the U.S. phosphate market to Australia could, therefore, have quite an effect on the distribution of overseas activities. END

Barite

Reginald Rowand
National Lead Co.

THE DOMESTIC barite industry showed a substantial recovery in 1959 as compared with depressed 1958 production. It is estimated that 880,000 tons of domestic barite was sold or used as compared to only 605,402 tons in 1958. As in previous years, the oil and gas well-drilling industry was the main outlet for the domestic barite producers.

In 1958, ground barite accounted for 90% of the barite sold or used in the U.S. with the remaining 10% consumed by barium chemical and lithopone manufacturers. Approximately 95% of the ground barite was supplied to the oil and gas well-drilling industry which uses the barite as a weighting agent in drilling fluids. Again in 1959, Arkansas led in domestic production, with Missouri second and Nevada third. Other states reporting production were California, Georgia, Idaho, Kentucky, Montana, South Carolina, Tennessee, and Washington.

Barite Production

	U. S.* (Short tons)	World* (Short tons)
1954	926,036	2,300,000
1955	1,114,117	2,700,000
1956	1,351,913	3,100,000
1957	1,304,542	3,500,000
1958	486,287	2,500,000

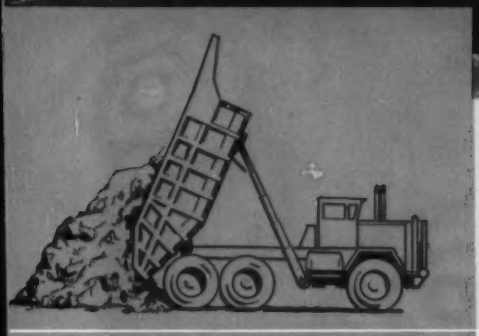
*Source U. S. Bureau of Mines.

Although 1959 was an improvement over 1958, the domestic barite industry is still far from recovering to the level reached in 1956 when some 1.3-million tons of domestic ore was sold or used. The two principal reasons for this relatively slow recovery are probably: (1) in recent years, more attention has been given to foreign oil and gas exploration thus reducing the consumption of the prime user of domestic barite, and (2) cost considerations have made it more advantageous to use foreign rather than domestic crude ore at certain coastal processing plants, especially those plants which supply ground barite to the domestic drilling industry.

Although statistics are not available for all of 1959, some 604,000 tons of barite was imported during the first 11 months of the year, or approximately 100,000 tons more than was imported for the same period of 1958. The imported ore was primarily for Texas and Louisiana coastal grinding plants which supply ground barite to the drilling industry.

The 1959 world barite statistics are not yet available. However, world production is expected to show some improvement over 1958 when 2.5-million tons were produced — 1-million tons less than the peak reached in 1957. In 1956, the U.S. produced 1,351,913 tons or 44% of world barite production. In 1958, the U.S. production amounted to only 486,287 tons or 19% of the world's production. This significant reduction in U.S. production has caused many domestic plants and mines to operate far below their capacity.

The future of the domestic barite industry will depend very largely on the activities of the oil and gas well-drilling industry, for this industry consumes over 85% of the domestic output. Indications are that the present level of barite consumption by the oil and gas industry is likely to form the pattern for some years to come. On the other hand, if the oil and gas producers were to renew their emphasis on domestic drilling, the barite industry in the U.S. could be expected to show substantial improvement. END



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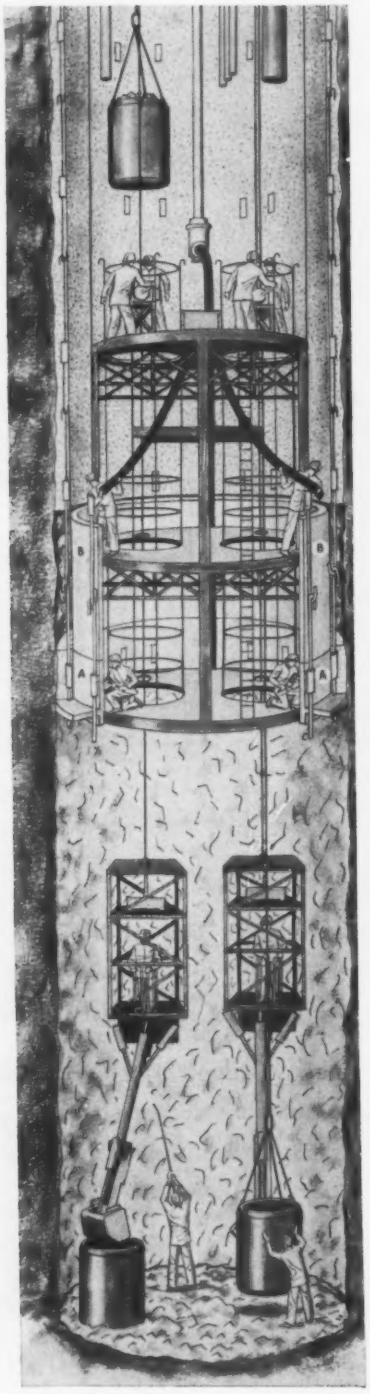
PRACTICE, PROCESS & PATENTS

IMC's "Triple-Decker" to Speed Esterhazy Sinking



AN INGENIOUS time-saver for shaft sinking is being built for International Minerals & Chemical Corp. to facilitate completion of a 3,000-ft circular shaft at the company's potash property in the Esterhazy area, Saskatchewan. Mobile "triple-decker" allows simultaneous mucking, concrete form preparation and shaft lining—shafts can be sunk three times as fast. The entire unit moves as a whole—during blasting the unit is raised 60 ft off the bottom. Service pipes and shaft facilities are installed from the top deck of the stage as sinking progresses. As shown in the drawing, the bottom half of a lining section (A) is placed and poured first, and allowed to set so as to provide a foundation for the top (B) section of the form. Similar units have been used in the gold fields of the Union of South Africa for deep sinkings (to 10,000 ft).

Courtesy the Rio Recorder

Preston East Dome Uses Sand Backfill

SHORTLY AFTER the first of the year, Preston Easton Dome Mines, Ltd. in the Porcupine area, Ontario, converted from waste-rock backfilling to the use of cyclone deslimed cyanide-mill tailings. The waste-rock pile on the surface has been depleted and the distances from the mill to the shafts precluded any economic transportation of mill sands by truck. Preston's manager Cy Greenacre installed two cyclones to make the sand, and cut a thickener out of the mill circuit and tied it into the cyclone overflow to reclaim as much water from the slimes as possible. Sand is pumped to a diamond drill hole (photo shows driller Jim Coza making the bore hole cut on the 4th level) near the shaft. Sand falls down the hole by gravity to the second level and is then piped about 2,000 ft to the active stopes on the fourth level of the mine. About 250-tons of clean, quick-settling sand is being backfilled a day and the RIO RECORDER reports that the method will reduce backfilling costs by one-third over the old waste-rock method.

(*Continued on p 162*)

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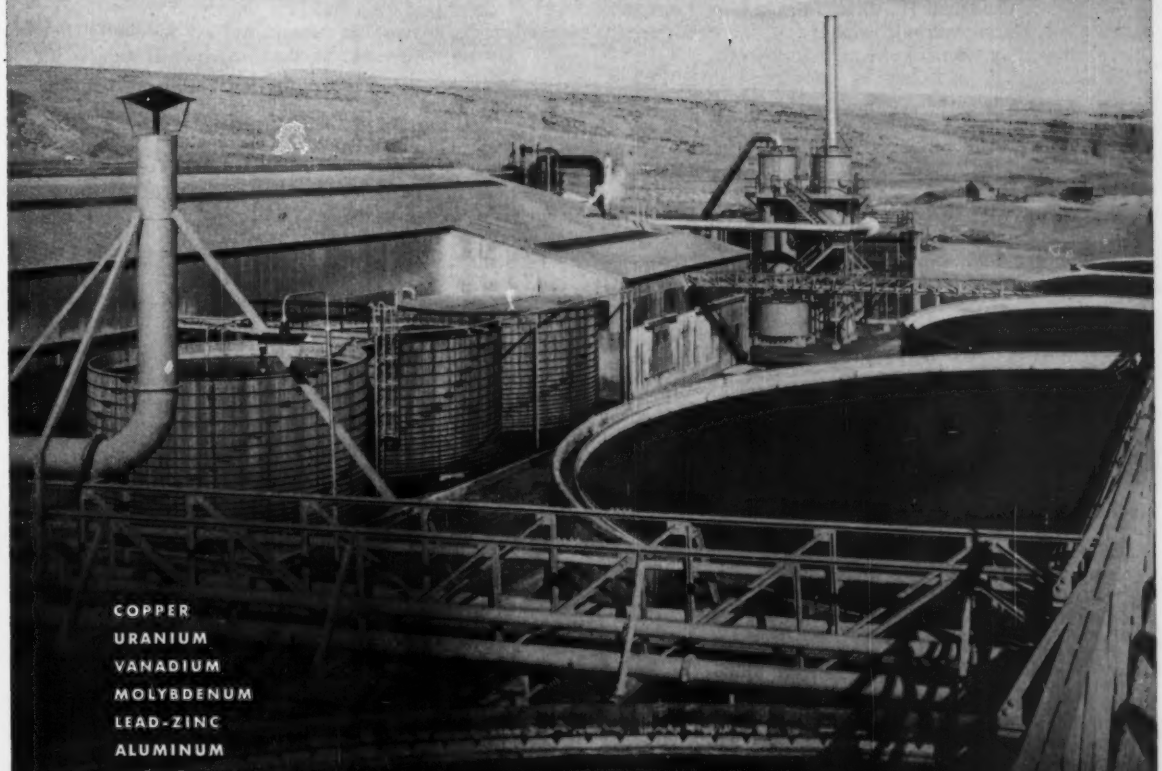

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Additional U.S., Canadian and British Patents Briefly Noted

Patent information is provided E&MJ by Oliver S. North, patent consultant, Washington, D.C. Mr. North also scans and abstracts the patents issued in Canada and Great Britain which appear below and which will appear in forthcoming issues of E&MJ. U.S. patents may be obtained from the Commissioner of Patents, Washington 25, D.C. (25c each); British patents from the Patent Office, London; and Canadian from the Patent Office, Ottawa.

What's New in U.S. Patents

Chute blasting package and method (R. F. Welsh, Jr.; E. I. du Pont de Nemours & Co.) . . 2,916,992
Blasting plug of polyvinyl chloride with fins (J. J. Douglass and C.M. Pomeroy; du Pont) . . 2,916,995
Ontario Research Foundation pelletizing method (see E&MJ, January 1958, p 88, P. E. Cavanagh, assigned to Ontario Research Foundation) 2,914,797
Leaching thorium from silicate ores of Lemhi Pass, Mont. (J. H. Gross; International Minerals & Chemical) 2,915,363
Extracting sulphur from ores with a centrifuge (O. O. Oaks and H. V. R. Scheel) 2,915,369
Furnace for treating volcanic sulphur (Y. Nobuo; assigned to Shikoku Kasei Kogyo Co., Ltd.) 2,915,374
Preparing chrome ore agglomerates (J. H. Brennan; Union Carbide) 2,915,378
Improved gas handling in direct reduction of iron process (J. C. Agarwal; U.S. Steel) 2,915,379
Concentrating minerals in a vapor stream (P. L. Paull; Texaco Development Corp.) 2,916,213
Chelation extraction of uranium, zirconium and plutonium (U.S. AEC) 2,916,349
Nitric acid process for recovering ferrous and nonferrous values from low-grade iron deposits—laterites, garnierites, taconites, ilmenites (F. A. Schaufelberger; American Cyanamid Co.) 2,916,357
Centrifugal concentrator (V. Rakowsky) 2,917,173
Magnetic device to remove magnetic minerals from flotation pulps (R. P. McNaught) 2,918,170
Improved shaft furnace for firing pellets (P. L. Steffensen; Bethlehem Steel Co.) 2,918,267
Method for producing large pellets in a rotating, heated retort (C. E. Lesher; Lesher & Assoc. Inc.) 2,918,364

These U.S. Patents Have Expired

Using tri-sodium phosphate to eliminate slimes (S. T. Cameron; Minerals Beneficiation, Inc.) 2,309,931
Using lime as an activator and mahogany sulphonate as a collector for siliceous, pyritical and arsenopyritical gold, barite, anglesite, lead oxides, suphides and sulphates of silver, native copper tailings and others (W. E. Keck) 2,310,240
Reductive recovery of manganese using a reducing gas and solid carbon (E. Riveroll) . . 2,310,258
Improvements in the Waelz kiln operation (E. W. Steckel and G. T. Mahler; New Jersey Zinc Co.) 2,310,471
Design of mercury furnace (F. Duncan) 2,311,648
Using sodium ferric fluoride to recover beryllium as the double fluoride salt from beryl (H. C. Kawecki) 2,312,297

Canadian Patents Recently Released

Chlorination and separation of columbium and tantalum from ores or mixed oxides (Ciba Ltd.) 585,999
Electric furnace production of titanium carbide from titanium-bearing materials (J. H. Brennan; Union Carbide) 586,036
Additional data on titanium carbide production J. G. Farmer and J. H. Brennan; Union Carbide) 586,042
Recovering columbium in solution by reaction with solid KCl which forms a double salt with the tantalum leaving purified columbium behid (W. Scheller; Ciba, Inc.) . . 586,056
Arrangements in the blast furnace flue for transferring zinc vapor to the condenser and operating the furnace so that the zinc leaves the furnace at below 800° C (S. E. Woods and L. J. Derham; Metallurgical Development Co.) 586,363
Chlorination of columbium as a means of separation from ore (W. A. Jenkins; du Pont) . . 586,395
Drum for cooling molten lead used in condensing zinc in the blast furnace (G. K. Williams and L. J. Derham; Metallurgical Dev. Co.) 586,397
Precipitating copper from ammoniacal cobalt-nickel solutions by adding pure sulphur (V. N. Mackiw, V. Kunda and R. L. Benoit, Sherritt Gordon) 586,406
Recovering tungsten as the trioxide by reaction with superheated steam at 900 to 1100° C and volatilization (H. M. Hubbard and R. W. Sanfter; E. I. du Pont 586,409
Controlling the temperature of the air used in iron or sintering (Metallgesellschaft A.G.) 586,421
Controlling slag conditions to prevent reoxidation of titanium contained (American Cyanamid) 586,422
Design of a two-stage fluidized reactor for roasting sulphides or sulphatizing. This is same as British patent 820,447 below (C. J. Wall; Dorr-Oliver) 586,790
Solvent extraction with dialkyl phosphate to recover vanadium and the treatment of the solvent phase to precipitate vanadium pentoxide (Union Carbide) 586,860
Solvent extraction of uranium with a dialkyl phosphate (R. A. Gustison and F. W. Hurd; Union Carbide) 586,921
Improvements in the process for direct reduction of iron ore (J. W. Halley; Inland Steel Co. 586,927
Apparatus for removing oversize material from calcined bauxite (F. L. Smidth & Co.) . . 587,211
Method of separating from solution gold, silver, platinum, lead, copper, palladium or mercury using polymeric hydrogen cyanide at elevated temperature (H. Zima assigned to Rohm & Haas Gmbh) 587,225

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All-Allis-Chalmers unit at Bryan Rock and Sand includes rubber-lined pump and SUPER-SEAL motor.

How Bryan Rock and Sand Company uses a rubber-lined pump to

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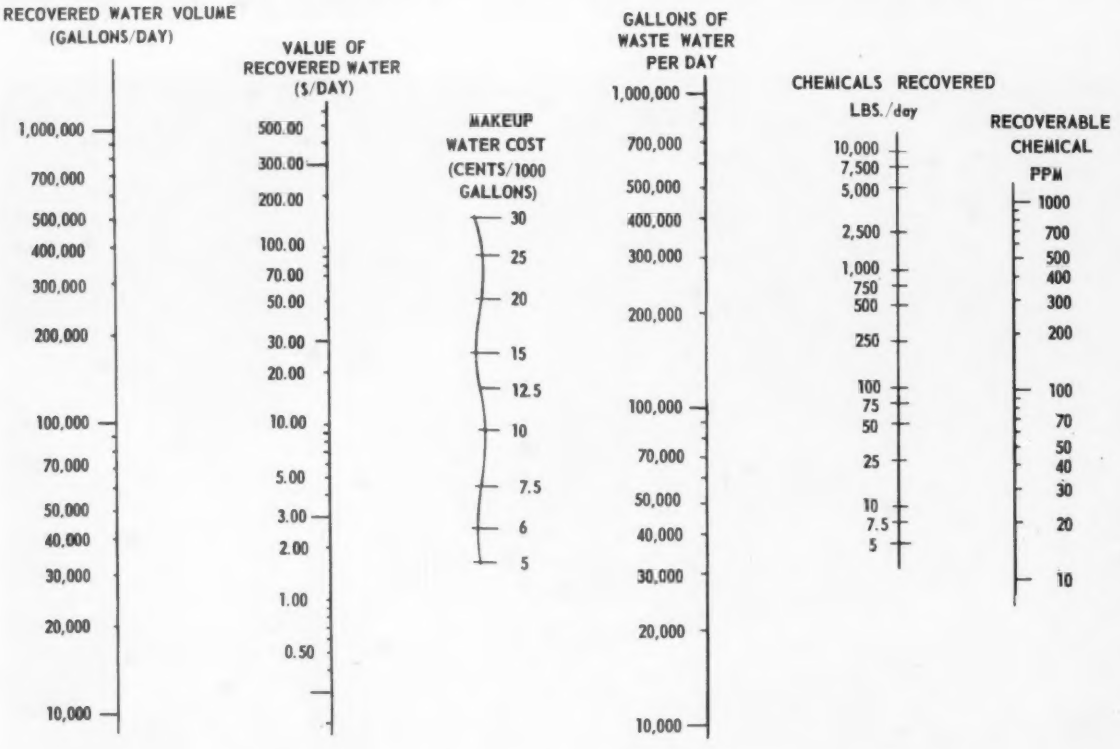
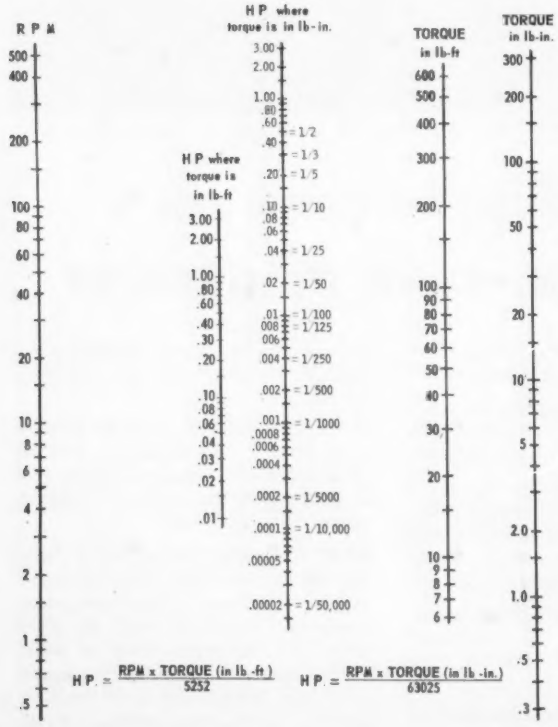
Super-Seal is an Allis-Chalmers trademark A-1222

OPERATING IDEAS



Nomographs Give Quick Data for Water Recovery and Horsepower



THE THREE ACCOMPANYING NOMOGRAPHS are easy-to-read references for the composition of recovered liquids and for horsepower values.

Nomographs I and II were issued by Graver Water Conditioning Co., New York. The first one deals with the value of recovered water and the other with the amount of waste chemical which can be recovered.

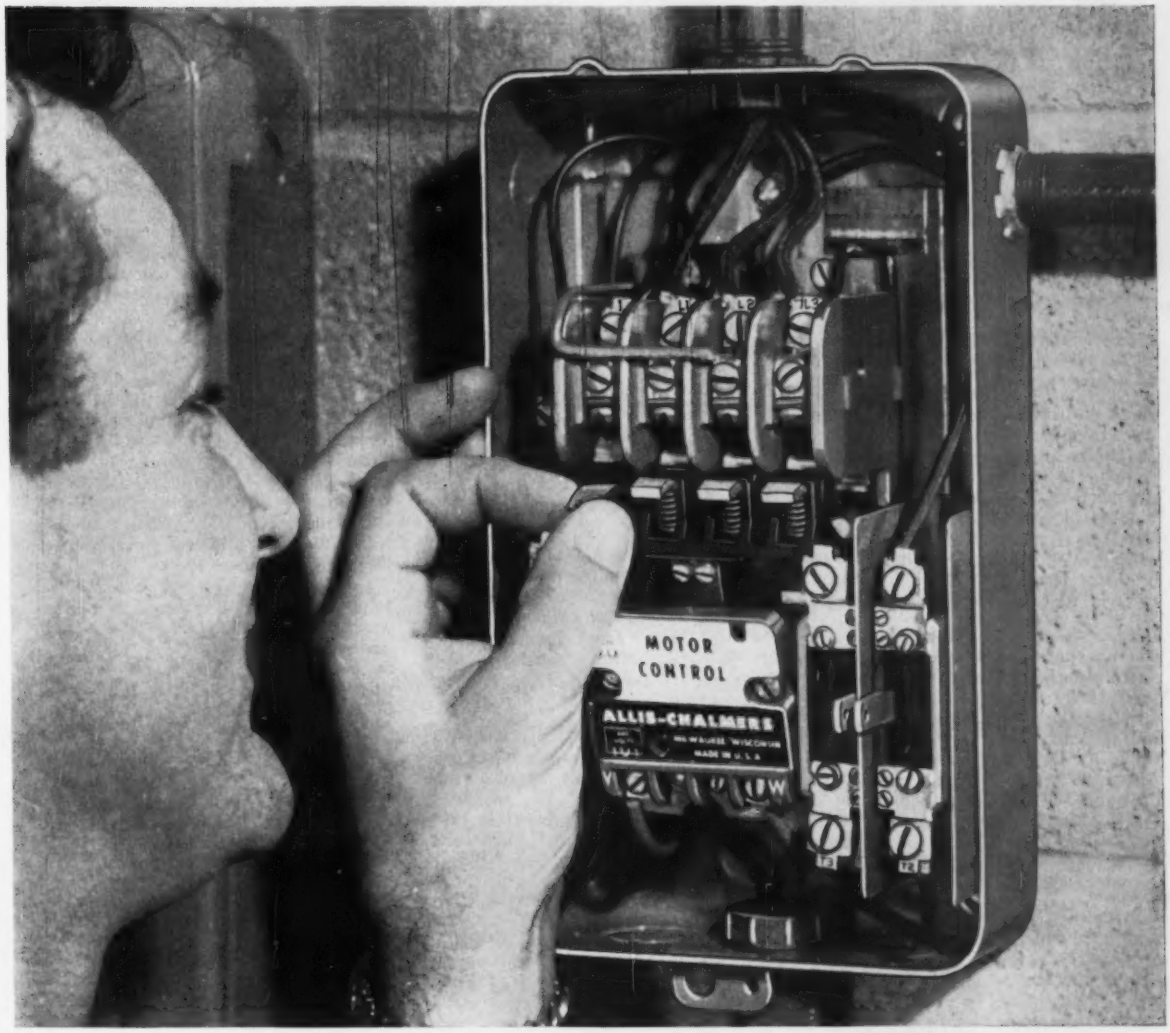
To use nomograph I, it is necessary to know the cost of the makeup water in cents/M gal and the average flow through the plant. The recovered water value is obtained by drawing a straight line on the nomograph. For example, if makeup water costs 12.5 cents/M gal and the plant flow is 500,000 gpd, a straight edge will show that the value of recovered water is about $60 per day.

To use nomograph II, it is necessary to know the amount of recoverable chemical in ppm and the volume of waste water in gpd. For example, 50ppm of recoverable chemical and a water volume of 200,000 means that about 85 lb of chemical can be recovered per day. This can be translated into dollars and cents by applying the market value of the particular chemical being recovered.

Nomograph III, issued by Merkle-Korff Gear Co., is a dual nomograph for horsepower, torque and rpm, is applicable to fractional horsepower motors and transmissions, and gives two scales each for torque and for horsepower.

The rpm values range from .5 to 500 while the upper limits of the two torque scales are 300 lb-in. and 600 lb-ft.

ALLIS-CHALMERS



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PERSONALS

Russel B. Caples, recently retired as vice president of the Anaconda Co., but will act as consultant to the company, according to **Clyde E. Weed,** board chairman.

Caples

In 1957, Mr. Caples received AIME's James Douglas medal for "distinguished achievements in extractive metallurgy, particularly in the electrowinning of zinc, and for outstanding success in stimulating the professional careers of many metallurgists.'

Caples started with the firm in 1910 in the testing and research departments at Anaconda, Mont.

Richard J. Hefler, vice president, American Potash & Chemical Corp., has been elected to the company's board of directors. He fills the vacancy created by the death of **William J. Hutchinson.**

Hefler joined AP&CC in 1948. He served as secretary of the company from 1953 to 1957 and as assistant to the president from 1954 until his appointment in 1957 as vice president, finance.

William H. Swayne has been appointed chief geologist of the Anaconda Co.'s South American Div. Mr. Swayne had been chief geologist, South American operations, Chile Exploration Co. and was headquartered at Chuquicamata, Chile, for the past four years.

Swayne joined Anaconda in 1940 in the company's geological department at Butte, Mont. In 1948, he was sent to Cia Sud Americana Explorada de Minas in Santiago, Chile, and in 1955, he moved to Chuquicamata.

Jean Vuillequez, vice president of American Metal Climax, Inc., has been elected president, chairman of the board, and chairman of the executive committee of the Lead Industries Association.

Vuillequez

Mr. Vuillequez is also a director and member of the executive committee of American Metal Climax and has been a member of the Lead Industries Association board since 1953. In addition to all this, Mr. Vuillequez is a director of the American Bureau of Metal Statistics, the American Zinc Institute, U.S. Copper Association and Copper Institute.

Anthony L. Payne has become associate professor of mining at Mackay School of Mines, Reno. He had been mining geologist with Shenon & Full in Salt Lake City and had worked in Cuba with Minas de Matahambre, in northern Peru and the southwestern U.S. with American Smelting & Refining Co., and in Colorado and Montana with the USGS mineral deposits branch. He is a graduate of the University of Utah and received his Ph.D. in economic geology from Stanford University.

D. B Grove, superintendent of the milling department of the Mascot, Tennessee operation of American Zinc Co. of Tennessee, retired January 1, after serving the company for 47 years.

James H. Polemus, Grove's assistant for a number of years, will succeed him as superintendent of the milling department.

Edward P. Cadwell, former field engineer for American Cyanamid Co. in Lima, Peru, has been promoted to chief metallurgist for Cyanamid International with headquarters in New York, according to an announcement by **H. L. Brown,** manager of Cyanamid International's mining chemicals department.

Cadwell

Mr. Cadwell has been Cyanamid's technical representative in South America since 1948.

In his article, Color Microscopy for the Mill Man (E&MJ January, 1959), Mr. Cadwell outlined a rapid method of mounting and polishing ore and mineral samples.

Thomas M. O'Malley, vice president in charge of marketing, Aero Service Corp., Philadelphia, has been elected to the firm's board of directors.

O'Malley joined the company in 1936. He headed Aero Service's affiliate, Canadian Aero Service Ltd., until he returned to Philadelphia about a year ago to direct the company's marketing program.

Fred W. Strandberg, chief mining engineer for the Anaconda Co. in Butte, has retired after a 43-year career in the mining field.

Strandberg came to Butte in 1916 and started as a miner in the Pennsylvania mine and later was transferred to the mining engineering department as an assistant engineer.

R. Davidson Piper, formerly Mr. Strandberg's assistant, succeeds him as chief mining engineer.

J. W. Borskey, Jr. has been appointed to the newly created position of manager, chemical operations for the Carlsbad plant of International Minerals & Chemical Corp., according to a recent statement by **E. C. Skinner,** operations manager.

Mr. Borskey joined Duval Texas Sulphur Co. and has been continuously associated with that company and its successor, Duval Sulphur & Potash Co., ever since. He became chief chemist for the company, and came to Carlsbad in 1949 to play a leading role in Duval's exploratory work in the potash basin and the design and construction of the firm's Carlsbad plant.

Lawrence A. Roe, director of development in the research, engineering and development division of International Minerals & Chemical Corp., has been appointed staff director, minerals processing—a new position.

Edward S. Frohling has been named business development engineer, eastern district, Western-Knapp Engineering Co., vice president and general manager **C. F. Skinner** recently announced.

Frohling has been associated with Climax Molybdenum Co. as plant metallurgist, St. Lawrence Fluorspar Inc. as mill manager and has been engaged in metallurgical work as a consultant and equipment application engineer.

William H. Swann, assistant plant manager of the Pacific Northwest Alloys plant at Mead, Wash., since 1956, has been named plant manager of the Montana Ferroalloys, Inc., plant at Memphis, Tenn.

Both firms are subsidiaries of Chromium Mining & Smelting Corp. Swann was formerly the chief engineer of Pacific Northwest Alloys and has been with Chromium Mining & Smelting and its subsidiaries since 1949.

John W. Hall has been named president of the Potash Company of America, it was announced by the board of directors. He succeeds **F. O. Davis** who will remain available to the company on a consultative basis.

Hall

Mr. Hall started with Potash Company of America ten years ago as Northern Regional Sales Manager. He was later appointed general sales manager and, for the past four years, has been vice president in charge of sales, a member of the board of directors, and a member of the board's executive committee. His new assignment will take him to the company's central headquarters at Denver.

Mr. Hall is a director of the American Potash Institute, a research and educational organization representing five major potash producers of the U.S. and Canada. He is also a director and executive committee member of the National Plant Food Institute, an organization representing the fertilizer industry of the nation.

At a recent dinner honoring **Louis Ware,** International Minerals & Chemical board chairman, it was announced that the firm had established a program of scholarship and fellowship awards in the field of agriculture and mining.

Called the "Louis Ware Scholarships for Outstanding Achievement in Agricultural and Mining Sciences," the program provides for twelve $1,000 senior year scholarships to students interested in graduate studies in the areas of min-

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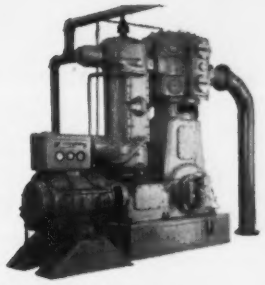

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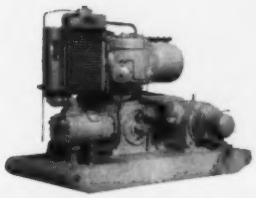

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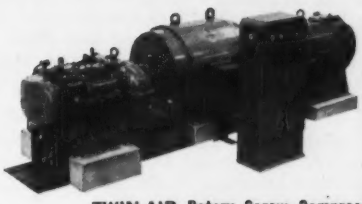

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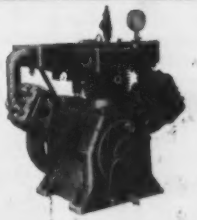

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ing and agriculture. The six students in each area would then compete, during their senior year, for a $3,000 annual fellowship leading to a doctorate degree.

Robert J. Linney, executive vice president, Reserve Mining Co., has been awarded AIME's William Laurence Saunders Gold Medal.

Linney

Mr. Linney will receive the award "for distinguished leadership and aggressive determination in bringing into successful commercial operation mining and beneficiation of taconite ore." Presentation will be made during the national convention of AIME, New York, Feb. 14-18.

Sheldon P. Wimpfen, former vice president of Glen Alden Corp. and official of the U.S. Atomic Energy Commission, has been appointed executive assistant to Walter L. Rice, president of Reynolds Mining Corp.

Wimpfen

Wimpfen had been assistant to the president of Western Machinery Corp. for the past year. While he was with the AEC from 1952 to 1956, Wimpfen was manager of the Grand Junction operations office, and in charge of the uranium raw materials procurement program in the western states.

Wraith

Graham

William Wraith, Jr. has been elected assistant vice president and **Thomas K. Graham** has been made metallurgical manager of the Anaconda Co.

Mr. Wraith was formerly the metallurgical manager—he will continue to direct and supervise the metallurgical operations of the company and its subsidiaries.

Mr. Graham was manager of the Raritan Copper Works of International Smelting & Refining Co., Perth Amboy, N.J., from 1956 to 1958. Since 1958, he has been assistant metallurgical manager.

E. B. Hotchkiss has been named executive vice president of Vitro Minerals Corp., according to the firm's president, Dr. Charles J. Potter.

Mr. Hotchkiss was executive vice president and director of New Enterprises, Inc., Boston, before joining Vitro in 1953. He is a director of Vitro; a member of the AIME, the American Institute of Chemical Engineers, and the Mining Club of New York. He is also a director of Kaman Aircraft Co., Bloomfield, Conn.

Walfred Johnson, mining captain at Inland Steel Co.'s Sherwood mine in Mineral Hills, Mich. for the past 15½ years, has retired. He has been succeeded by **Peter J. Ropiak.**

Philip D. Pearson, Ishpeming, manager of mines for Inland, has also announced the appointment of **Vanner H. Takala** as mining captain and **John A. Long** as shift boss at the Bristol mine at Crystal Falls.

OBITUARIES

Rudolph T. Elstad, 64, president of U.S. Steel Corp.'s Oliver Iron Mining Div. for the past 13 years, died Dec. 14 at Duluth.

Mr. Elstad joined Oliver 40 years ago as a mining engineer in the Canisteo district of the Mesabi range.

He came to Oliver's Duluth headquarters in 1938 as an assistant to the vice president and general manager. He became president in 1946.

In an appreciation that appeared in the December issue of Oliver's magazine, ORE, IRON AND MEN, Mr. Elstad was praised for his "contribution toward the progress of the iron ore mining industry that won him recognition not only in Minnesota but throughout the nation. Keenly interested in the development of Minnesota's resources and an active participant in the civic activities in this region, he was a director and officer of many organizations seeking to further the economic and social growth of this area."

Miss Mary C. Maddigan, 54, executive of a number of Ontario mining firms, died January 3 at Charlottetown, Prince Edward Island.

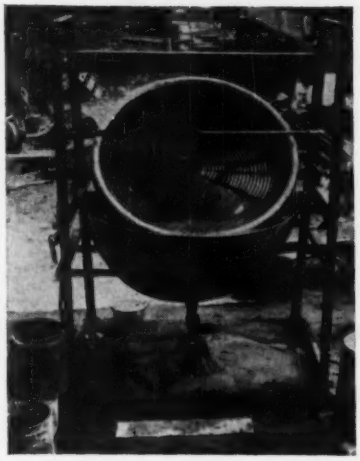
Miss Maddigan was secretary-treasurer of Little Long Lac Gold Mines, Lake Shore Mines, Wright-Hargreaves Mines, East Malartic Mines and Barnat Mines. She was a director of a number of other mining companies, mostly gold mines in Ontario.

Earle B. Gibbs, 73, a veteran Spokane area mining man, died December 20 at Colville, Wash.

Mr. Gibbs took over operation of the long-abandoned Bonanza lead mine north of Colville in 1944. Over a six-year period he took out more than $2-million worth of ore and the property once ranked as Washington's largest lead mine.

The Anaconda Co. later took a purchase option on the property and paid Gibbs and his partner $700,000 in payments and royalties before relinquishing the option in 1953. Gibbs was also instrumental in the reactivation and development of several other mining properties in the Stevens County area of northeastern Washington.

LETTERS



Can you kindly advise me as to the name of the original designer and inventor of the "gold recovery wheel," when it was placed on the market and if a patent exists on this piece of equipment?

Any information you can forward me regarding this recovery wheel shall be appreciated.

R. J. Lanford,
322 East Broadway,
Glendale 5, Calif.

Can anyone help Mr. Lanford?—ed.

Advantage and Disadvantage

I found two Chinese words in the editorial, "The Chinese Had Two Words For It," (E&MJ, November 1959, p 81). One of these words, however, is incorrect. It should be written as:

害 利

Disaster **Advantage**

Peter S. H. Pang

害 利 利害

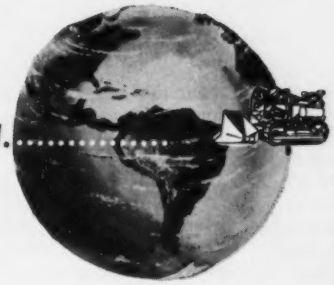
(A) **(B)** **(C)**

According to Mathew's Chinese-English Dictionary, Revised American Edition, radical 40; 2015, (A), when appearing by itself, means "to injure, to destroy. Injury. To suffer, to take a disease." The same source defines radical 18; 3867, (B), as "profit, gain, advantage. Interest on money."

One of the definitions appearing under 2015 is (C) and means "advantage and disadvantage." When the same combination, (C), appears under 3867, it is defined as "profit and injury."

For a more precise presentation of "advantage and disadvantage," E&MJ could have used (C) with the definition appearing under 2015.

E&MJ expresses thanks to King Typographic Service, New York, for its valuable language assistance.



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Noreno Brasil S.A., Sao Paulo, entered into an agreement with the Companhia Hydroeletrica do Rio Pardo for construction of a tunnel and compensation chamber at Euclides Da Cunha, Sao Jose do Rio Pardo. The tunnel inlet measured 380 m. in length and 50 sq. m. of section. The machine house and compensation chamber, with the tunnel, totaled 52,500 cu. m. of rocks with a tunnel outlet 1,980 m. in length and 55 sq. m. of section.

Five Eimco 105 machines were purchased through Eimco's Distributor in Brazil, Messrs. Bandeira de Mello, S.A., Sao Paulo, Brazil, and were the only machines used for loading the entire excavating works, which exceeded a volume of 190,000 cu.m. Noreno Brasil S. A. reports, in part:

"Eimco loading machines were the only ones used and the model 105 was fully responsible for the good and regular execution of the whole work with the help, in certain sections, of our own Eimco models 21 and 40.

"Were it not for the help of these machines, we could never have obtained an average monthly production of 100 m., or the record, reached in perforation work, of 135 m. in one single month, at a distance of 1,200 m. from the starting entrance.

"We . . . emphasize the exceptional moving and handling qualities, production capacity and resistance of the machines and enclose photos and particulars of the work performed so as to illustrate still better the . . . capacity of the Eimco 105 Excavators which the Companhia Hydroeletrica do Rio Pardo were fortunate enough to buy and use for such work."

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Gilberto Vergueiro da Silva

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last. The U.S. as well as the U.K. and the industrial countries of Europe are normally net importers of copper. With the U.S. 1.7c per lb import duty, ordinarily copper will be priced higher to the consumer than in countries in which there is no import duty. But for a while this was not true.

Copper prices were bouncing up as 1959 started out. Demand had been increasing following the U.S. recession and stocks held by refiners had dropped sharply late in 1958. Some firms that had cut output began to feel they had not rescinded the cuts soon enough. The U.S. producer price was raised 1c to 30c by Phelps Dodge Feb. 2; the other two large U.S. producers followed on the 3rd. London on the last day of January had been £241¾ (30.2c) for prompt.

Allocation of metal was resorted to by some U.S. producers. Many fabricators complained that they were unable to get even the minimum amounts for which their understanding with the sellers in the U.S. had called. Part of this push for metal reflected the strong view early in the year that the copper producing industries in the U.S. would be struck as contracts with labor organizations ware terminated.

Custom smelters moved prices up. At the beginning of February they were at 30c a lb delivered. By March 16 custom smelters were getting 34c a lb for copper sold in the U.S.

Sustained high output and some doubts about future strikes in the U.S. eased prices in April. London Metal Exchange quotations had moved down late in March. Prompt bid had hit a high of £257½ (32⅜c a lb) March 17. On April 9 when custom smelter prices started down in the U.S. it was £244½ (30½c). Within two days the U.S. smelters were selling at 32c.

U.S. Government inventories of copper, it was reported in mid-April, might be released to industry if a shortage developed. The Office of Civilian Defense Mobilization was considering releasing copper from the Defense Production Act inventory—it was rumored that about 128,000 tons were available. This report contributed to the easing of prices in and outside the U.S. Western Congressmen soon made their views felt and it became clear that no copper would be released until after a strike was over and maybe not then, that only a small part would be sold and that its sale would be spread out.

The U.K. Government had been releasing copper to industry since November of 1958. It had released 10,000 tons in the three months November 1958—January 1959. On Dec. 31, 1958 it said it had an additional 30,000 tons and that this would be sold rather evenly February through November 1959. It did sell it off; a little less than half went to the original suppliers. The U.K. Government has no more copper. With many mines, smelters and refineries back in production and increasing amounts of refined copper coming on the market in the U.S. there is little reason to suppose U.S. Government copper will be released to industry.

Prices in the U.S. appeared to firm a little when it became clear the Government would not trot out its metal. Smelters boosted ½c to 32½c about April 21—but this lasted hardly more than a week. More people were beginning to ask themselves: "What will happen if there are no strikes?" All knew what would happen—there would be too much copper and prices would drop, and fast. The guessing game was on. Much could be made by a right guess—and much could be lost by a wrong guess. Some were able to hedge their operations, or at least partly hedge them.

Beginning in December 1958 Free World refined output, as measured by Copper Institute figures was at an annual rate of about 3,400,000 short tons. Refined stocks mounted from 262,544 tons at the end of December to 350,772 tons at the end of May 1959. This at a time when some fabricators were taking all they could get with the view copper strikes might push prices up sharply. U.S. stocks remained steady at about 80,000 tons—a varying amount of this was metal in Commodity Exchange warehouses. A small amount located at the refineries was owned by merchants. The world refined stock figure (copper held by sellers) peaked at 390,168 tons at the end of July.

Prompt bid in London dropped to £230¼ May 5. By the end of the month it was about £10 higher—but this did not last. The fear there might not be strikes brought the LME down to £217½ on June 26. Custom smelters in the U.S. were charging 32c at the beginning of June but by mid-June were at the producer 31½c price and the last few days of the month they were at 30c. Producers stayed with the 31½c. Merchants were slightly under the custom smelters. Katanga had dropped to 27.45c from 30.2c. Many factors began to feel labor unions in copper in the U.S. would not call their members but—rather, they would continue to work until the steel strike was settled and then would accept about the same gains. London quotations continued to ease and hit bottom at £209¼ (26⅛c) July 10.

U.S. producers cut 1½c off their price. Kennecott announced July 13 its price beginning July 14 would be 30c a lb delivered. Phelps Dodge followed the same day and Anaconda the 15th. Katanga dropped to 26.3c. Custom smelters had offered at 29c on the 13th. Merchants had preceded them to that price.

Production cuts were announced. The memory of 1957 and early 1958 were fresh—cuts had been too slow then. Or at least many felt output flexibility was better than price flexibility and in order to prevent prices from again getting too low, output reduction should not wait. Phelps Dodge said simultaneous with the drop in its price that it was cutting production 7% relative to its first half 1959 rate. Rhodesian Selection Trust companies about July 16 said they would cut about 10%.

The willingness of producers to cut output firmed the market and London recovered somewhat. Weak holders of contracts on the LME were also probably forced out.

Within three weeks the first of the big strikes had hit—Phelps Dodge's Laurel Hill refinery went down Aug. 1. But, by then fabricator stocks were high and those held by producers, especially outside the U.S., were up. Other strikes hit in August. London prices firmed a little; but now many were saying the strikes had to last two months before there would be a shortage, and maybe longer. Smelters late in July were selling at 29½c; they hit 30c about the end of the first week of August. London was only £10 higher on Aug. 31 than on Aug. 4, the first business day of the month. Merchants in the U.S. reached 33c. Two custom smelters in the U.S. withdrew from the market but American Metal Climax announced a 33c price.

On Sept. 9 White Pine raised to 31½c delivered. Anaconda then said its deliveries of foreign copper would be at 31½c in the U.S. including the 1.7c import duty. Its other copper was also raised to 31½c. Brass firms raised prices. Phelps Dodge said it was no longer a copper seller. Kennecott's fabricating subsidiary stayed with the 30c base product price for about another month. In September, London prices eased somewhat.

Shortages ahead appeared more likely in October. On the 2nd, Kennecott's Braden property in Chile was struck—London immediately jumped

(Continued on p 172)

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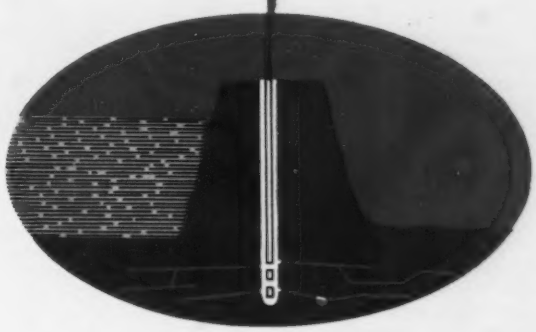

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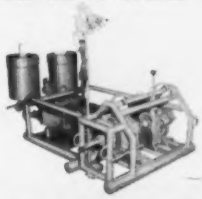

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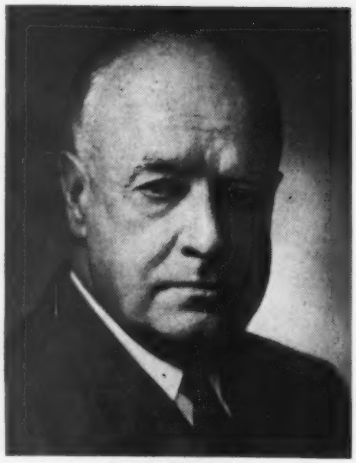
Copper—*Continued from p 170*

about £6. It rose about £30 for prompt copper in October and forward moved up about £15, almost 2c. Copper Institute data showed that mine ouput in September in the U.S. had dropped to 19,503 tons—it was to remain at about this level through the year; but almost no one thought the strikes would last so long. Refined output dropped to 44,648, about a third of "normal," and it too stayed near this amount through the year.

Refined copper surged into the U.S. In September 40,284 tons came in. In October they dropped off, but in November 43,713 tons were imported. Much of this was copper brought in by merchants. These permitted fabricators to keep their mills going. Probably December imports were about 34,000. At the beginning of October Kennecott quoted 30c, other U.S. producers 31½c and some custom smelter copper was priced at 33c. Some imported producer copper was being sold at 34.7c including the import duty. Merchants started October at about 34½c but ended it near 39c in the U.S.

Kennecott boosted its price to 33c a lb delivered Dec. 1; others followed in the U.S. The Kennecott announcement came after the first break in the big strikes. It had reached agreement with the United Steelworkers under which the workers got about 22.3c per hour. This was not greatly different from the American Metal settlement and others which were to follow. But it did not mean copper would flow. The Asarco settlement a little later loosed some metal.

Things to remember are given us by copper events of 1959. Producers appear quicker to cut output—some, probably most, greatly prefer production flexibility to price flexibility; this requires good calculating. Labor can strike for a longer period than many had thought—and is willing to do it. Stocks—fabricator plus refinery—may be greater than appears. Maximum mine output (take the maximum outside the U.S.—December 1959—and the maximum in the U.S.—May 1959) is likely to mean a considerable surplus; the refineries can handle it (Kennecott's new Eastern refinery in Maryland began to operate in the fall of 1959). Buyers are less prone to panic at the approach of shortages than they were three years ago. The U.S. Government is not likely in the near future to sell its surplus of important metals—it will give in to the heavy pressure not to sell. END



R. F. Goodwin

Rio Blanco *(Continued)*

tee of Southern Peru Copper Corp., has joined CdeP as mining consultant and will "initially devote his efforts exclusively" to Rio Blanco.

Early drilling has indicated reserves of about 116-million tons of 1.6% copper ore, Robert P. Koenig, president of Cerro, said. Plans include a 3½-mile development drift under the orebody.

Negotiations with the government of Chile, plus financial arrangements and more engineering work, must be completed, Koenig noted, before the final decision to start the project is made.

National Defense Minerals Plans Mill for Pegmatites

A NEW MINING VENTURE, whose first giant step is the construction of a 100-tpd flotation mill, will process the material near the Keystone mining properties in the Black Hills of South Dakota.

Northwest Defense Materials, Inc. announces that its flotation mill, which will use reagents for recovery of beryllium concentrates is already two thirds equipped. The company controls materials stocked near the Keystone mill which were assayed for beryl content in a program initiated by USBM, and found to have a grade of commercially recoverable beryl.

Northwest Defense Materials also holds large gravel deposits reportedly containing gold, Cb-Ta, tin and tungsten "which have eroded from the many pegmatite dikes in the Spearfish-Tinton area, 40 miles north of Keystone." The property was certified for a DMEA contract (now OME), and negotiations now under way would put a placer in operation.

The firm has received an offer from Brush Beryllium for 400 tons of beryl-flotation concentrates of 10.5% BeO contained. The mill circuit is based on pilot plant runs at USBM headquarters at Rapid City, which in turn treated samples from 75 Keystone properties, many of which are now controlled by NDM.

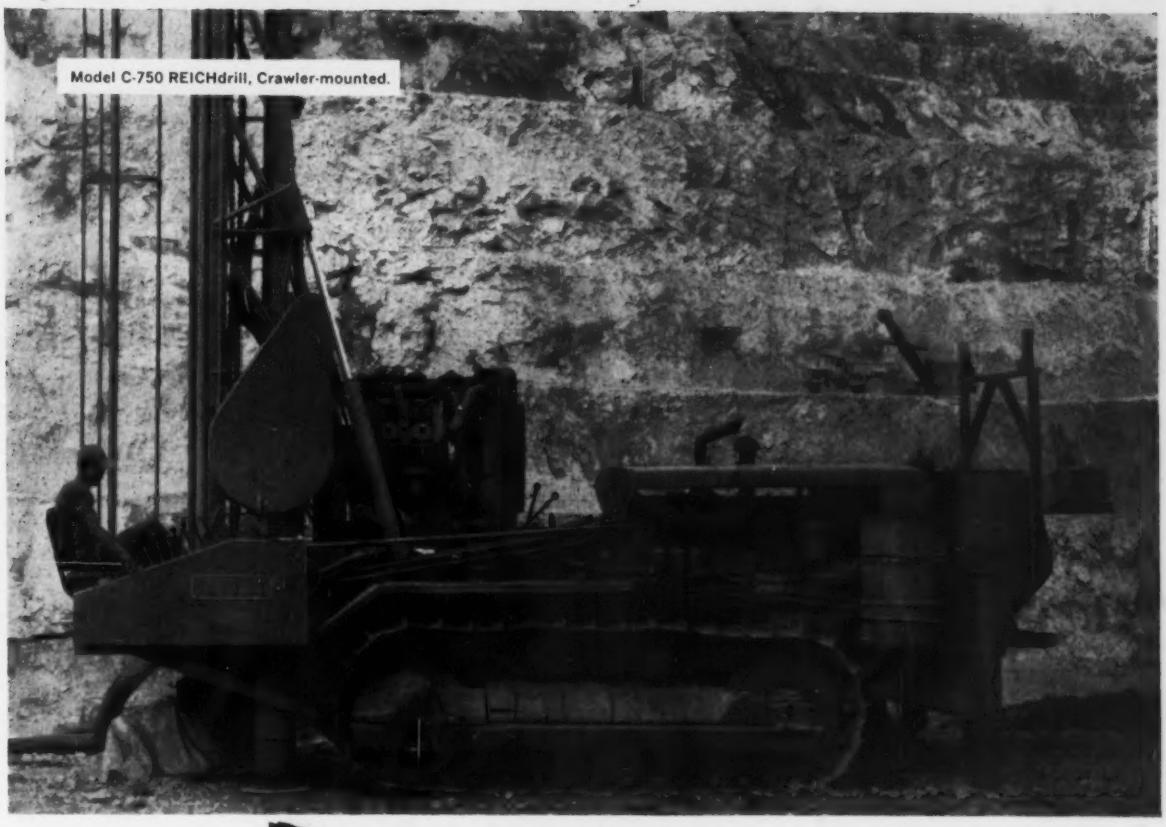
The mining engineer for the company is A. I. Johnson, and R. M. Atwater and Cloyd M. Smith are consultants. Peggy Keenan, Spearfish, S.D. is president of the firm.

COMPLEX concentration setup, one of Europe's largest, treats Strassa's iron ore.

New Methods Revive Sweden's Strassa Mine

EQUIPPED with what is claimed to be the most modern mining machinery in Europe, Grangesberg Co.'s Strassa iron-ore mine was reopened last Oct. 29 after having been idle since 1923. The reopening is part of Grangesberg's large-scale investment program, made possible by selling its 50% interest in LKAB (Lapland Ore Fields) to the Swedish government in 1957.

The $12-million Strassa mine will have an estimated output of 1-million tpy, making it the fourth largest mine in Sweden.



Model C-750 REICHdrill, Crawler-mounted.

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And here are 4 rugged reasons why:

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4. Extra heavy-duty construction on all component parts, including pumps, gears and frame means rig can take long, high speed duty without costly maintenance. Plus other field-proven features like hydraulic stem loader and down-the-hole hammer.

Units can be supplied truck or crawler mounted to suit operating conditions. Hole up to 12″ diam. Down pressure to 75,000 lbs. Write for detailed information on REICHdrills.

REICHdrill *Division: Chicago Pneumatic Tool Company*

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DIESEL ENGINE hauls iron ore from Paiyunopo mines to China's new works.

China's New Paotow Steel Center Opens

PAOTOW, an obscure collecting point for leather, furs and grain until five years ago, is now a much talked about steel center on the Inner Mongolian steppe, northwest of China.

Remote in the north of the Great Wall, the collecting point called little or no attention until the Chinese tapped natural resources of iron ore, coal and the abundance of water in the neighborhood of Paotow in 1950—iron ore from Paiyunopo, 81 miles west of Paotow, coking coal and other coal from Shihkuaikou, east of the metallurgical center, and water from the Yellow River.

Data collected, actual construction of Paotow Steel Center began in July 1957 and the first heat of pig iron flowed from Paotow's No. 1 blast furnace on September 26 this year. The furnace has a volume of 52,955 cubic ft with production capacity of 2,500 tpd of pig.

IN THE U.S.

ALASKA

The State Bureau of Mines has reported that Alaska mineral production declined 7% from $26,450,000 in 1958 to $19,880,000 in 1959.

Sand and gravel, petroleum, uranium, and mercury production increased during 1959 but this increase was more than offset by a production decline of coal, gold and stone.

Gold production, the state's leading mineral industry in terms of dollar value, continued to decline during 1959. Production was off 8% during the year compared with 1958. Production for 1959 was 171,000 troy oz compared with 186,435 oz in 1958, or in terms of value, $6,525,000 compared to $7,541,000 in 1958.

The Bureau of Mines report showed that coal production was down about 15% in 1959. The decline was attributed to less buying of coal by the military which utilized reserve stocks instead of buying new coal during the year.

Mercury production was up about 11% in 1959 with some 3,750 flasks (76 lb each) worth $852,000. In 1958, production amounted to 3,380 flasks.

The mercury production was from two mines in the state—the Red Devil and Schaefer mines, both in the Kuskokwim River area.

ARIZONA

In spite of strikes which paralyzed the copper industry for a time last year, 1959's mineral production in Arizona increased by $11.8-million, it was disclosed in a preliminary report from the state department of mineral resources.

Last year's total was $326.3-million. The increase resulted from boosts in value of the output of copper ($10.6-million), zinc ($2.9-million), and gains in value of manganese ore, molybdenum and vanadium.

Metals accounted for 93% ($302-million) of the total value of mineral production, of which copper alone amounted to 82% or $266.1-million. Nonmetals made up the remaining 7% or $24-million.

Copper production was 56,639 tons less in 1959 than in 1958 because of strike-caused inactivity at the major copper mines in Arizona last year. However, the total value of copper produced increased as a result of the higher average annual price.

Virtually out of production from mid-August until the year's end were the Copper Queen and Morenci branch operation of Phelps Dodge Corp.; Ray division operation of Kennecott Copper and the Magma and San Manuel operations of Magma Copper Co.

CALIFORNIA

Miracle Mining Corp. has reported results of 25 analyses of its property which indicate a large rare minerals deposit in the Randsburg District, northeast of Johannesburg, on the south shore of Searles Lake. The deposit was originally discovered by Joseph L. Foiste, who, with Emil Shore of Los Angeles and D. L. Mayhew of Alhambra, formed Miracle Mining.

COLORADO

Small prospecting increased but most other branches of the mining industry lost ground or barely held even in Colorado during 1959.

Metal production, at $94-million, increased 15%. Nonmetallic minerals remained the same as 1958 with production at $44.3-million.

Molybdenum ranked first in value for minerals produced in 1959, followed by uranium, vanadium and zinc. All the state's molybdenum was produced at the Climax Molybdenum Co. mine in Lake County.

Near year's end, prospects for 1960 brightened with the announcement of several major projects that are expected to spur production of base metals, uranium and molybdenum.

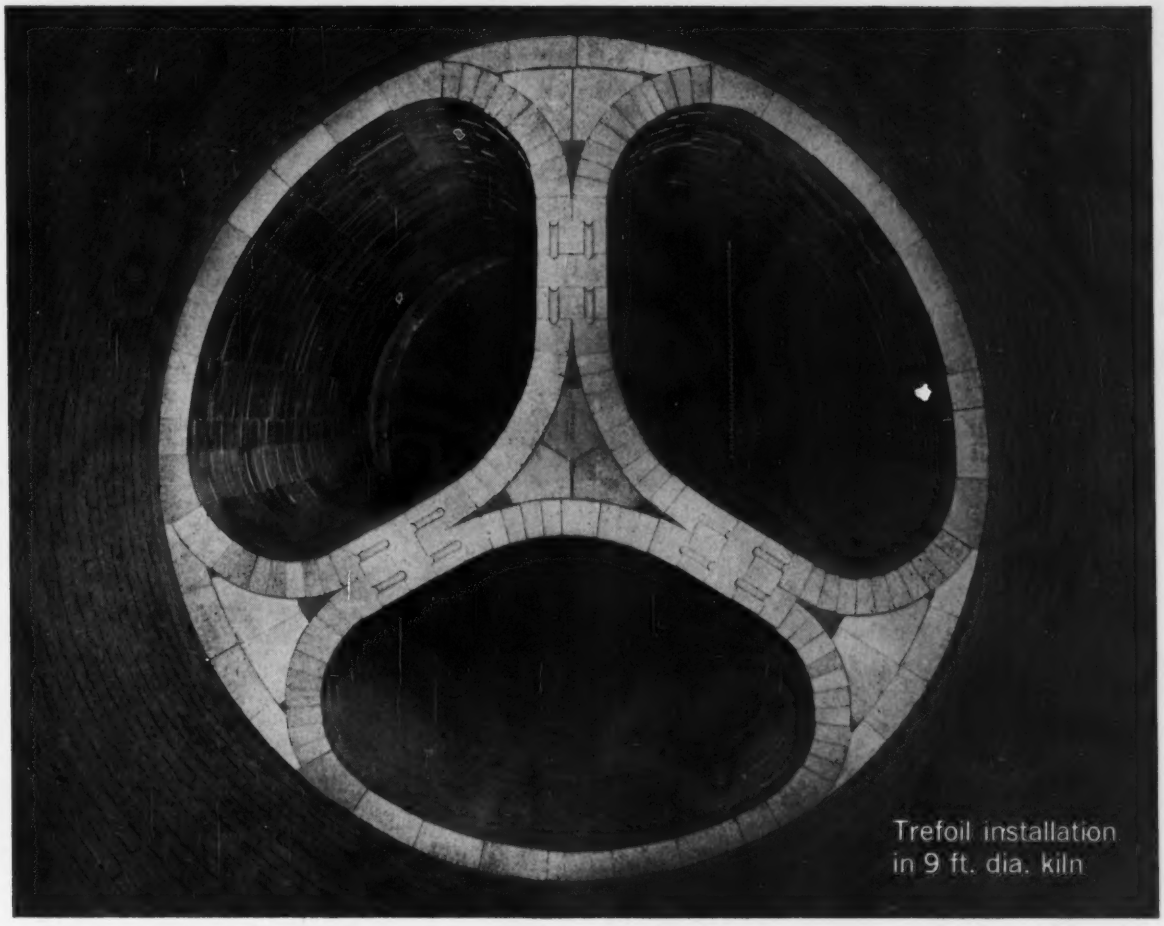
Late in 1959, Standard Uranium Co. announced broad plans for extensive base metal operations in the Silverton and Crested Butte areas of southwestern Colorado.

Standard, which has been successful in Utah uranium, is diversifying operations into base metals. The firm leased the Sunnyside mine properties from U.S. Smelting at Silverton and acquired the Marcy-Shenandoah's base metal mill near Silverton. This 500-tpd mill, one of the state's largest, has been shut down more than three years.

Rehabilitation of the milling equipment has started and the reopening of the Sunnyside mines is in progress, according to Russell Wood, general manager for Standard. The firm has also acquired a 75-ton base metals mill near Crested Butte and is developing ore supplies. The mills at Silverton and Crested Butte are scheduled for operation in 1960.

American Climax Co. molybdenum mill at Climax announced near year's end plans for a new shaft to be sunk in 1960. Production during 1959 did not change significantly from former years.

Base metals operations in 1959 were generally about the same as in recent years—with one major exception. There was no mining at fabled Leadville. This



Trefoil installation
in 9 ft. dia. kiln

Refractory Heat Exchangers increase rotary kiln efficiency

Harbison-Walker TREFOIL design provides important benefits

This construction built with refractories especially suited for the purpose is showing exceedingly gratifying economies in rotary limestone and lime sludge kilns. Its use is the means of imparting sensible heat to the charge, even to the degree of partial calcination in some installations.

The structural strength of the trefoil construction is proving its excellent durability. An original installation in a 10′ diameter kiln has now been in service for three years, with indications of considerably longer life. This good service presently is approaching repetition in a number of other kilns.

The magnitude of preheating of the charge in passing through the trefoil tends to moderate the temperature in the hottest zone, necessary for a given rate of production. The development of excessive accretions in the high temperature zones with certain fuels may be reduced and the lining life extended.

Net results from the use of the trefoil are fuel savings and increased production in kilns which are not greatly overloaded beyond rated capacities.

H-W technical service is freely offered in helping determine various details such as length of the trefoil section (usually 15 to 25 ft.) and longitudinal location for the various conditions involved.

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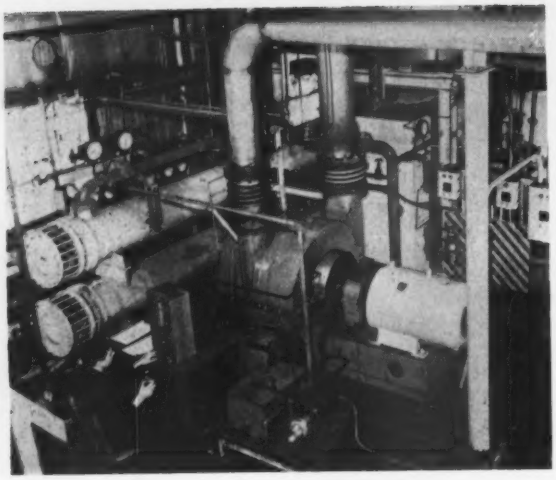

T-G and Inco Announce Sulphur Output from Roaster Gases

Sulphur production from roaster off-gas has been accomplished in a pilot plant at Copper Cliff, Ont., according to a joint announcement by Texas Gulf Sulphur Co. and International Nickel Co. Further pilot operations, the firms said, will determine "feasibility of large tonnage commercial production."

The $500,000 testing plant has been running 24 hours a day since April 1959. The sulphur is extracted by reacting the high quality roaster gas with a chemical reducing agent at elevated temperatures over a catalyst. The reducing agent may be natural gas, propane gas, or fuel oil, the announcement said.

Texas Gulf Sulphur Laboratories proved the practice before it was attempted in the pilot plant. Inco has been producing sulphuric acid and liquid sulphur dioxide from smelter gases, but has long sought a method for reduction to the more easily handled elemental sulphur.

Colorado *(Continued)*

was the first time since 1858 there was no production from Leadville mines.

The major operations continue to be the Empire Zinc Co. Division of New Jersey Zinc at Gilman; Idarado Mines at Telluride; Rico-Argentine at Rico and the Emperus Mining Co. at Creede.

Fluorspar mining at Cowdery in Jackson County and near Boulder in Boulder County was suspended during the year because of foreign competition. Imports also dealt a body blow to tungsten mining in Boulder County. The resumption of tungsten and fluorspar mining depends upon limitation of imports, Colorado mining experts said.

Uranium operations continued in 1959 at generally the level of 1958 and past recent years. Stepped up activities on Colorado's eastern slope during 1960 were promised with the signing of a new contract with the AEC by the Cotter Corp., which operates a uranium mill at Canon City.

Uranium ore production increased in 1959 by 11%, but the total value advanced only slightly because the ore declined from an average of 0.28% uranium oxide in 1958 to 0.26 in 1959.

Mining of beryllium ores in northern Colorado experienced waves of yo-yo like operations—some months there was activity and in other months nothing was done. Operations were at a standstill at year's end.

Colorado, once the gold and silver capital of the world, produced $2.1-million in gold in 1959, a decrease of $600,000 over 1958. Silver production amounted to $1.2-million, compared with $1.8-million in 1958.

Operating assets of Humphreys Gold Corp. have been sold to Humphreys Engineering Co., Denver, effective Dec. 31, 1959. These assets include the mining and concentrating plants near Jacksonville, Fla. Humphreys Mining Co., division of Humphreys Engineering, will continue to operate the facilities under the direction of the former Humphreys Gold management.

The other principal activity of Humphreys Engineering Company is the manufacture and sale of Humphreys spiral concentrators.

Operations at the Ajax mine near Cripple Creek have been resumed after a two-week layoff at the site below the Carlton Tunnel. There are two levels of operations below the tunnel; one at 130 ft the other at 80 ft. The upper level has been leased to Olson & Nolan and the company is working the lower.

The Gold Links mining property, 25 miles northeast of Gunnison is being reworked under split check lease arrangements between the operator, Revenue Metal Mines Corp. of Boulder, and M. J. Kraft and Associates.

Work at the property started the first of last week on a block of ground adjacent to the Morris winze which in the past has produced gold, silver and lead from a hanging wall fracture.

Sam R. Smith and E. W. Thaete, partners in a Colorado Springs mining company, have recently started development and exploration work on the former "Silver Key" mine, approximately one half mile southwest of Lake City on Henson Creek.

HAWAII

USGS is making a study of bauxite on the Hawaiian island of Kauai, and the results may be highly significant for the future of mining in the new State. Private industry has also expressed interest. Kaiser Aluminum Co., Reynolds Metals Co., Aluminum Co. of Canada, and Olin-Mathieson Co. have conducted exploratory surveys of Hawaiian deposits.

Dr. Agatin T. Abbott, Associate Professor of geology at the University of Hawaii, reports that bauxite appears in significant amounts on the islands of Kauia, Maui, and Hawaii. Most frequently occurring form is gibbsite, which is a hydrous form with the formula $Al_2O_3 \cdot 3H_2O$. Gibbsite appears near the surface, and could be mined by strip methods.

Tests have indicated that after stripping the subsoil is surprisingly fertile, making possible an additional bonus for agriculture.

Sampling of bauxite ore from the Islands of Kauai, Maui, and Hawaii by representatives of the Bureau of Mines was completed in June 1959, and research on the beneficiation of the ore and the extraction of alumina was being conducted at the Bureau of Mines' Metallurgy Research Center, Rolla. Consideration was also being given to the possible recovery of by-products, such as iron and titanium oxides.

According to preliminary data received by USBM, the total value of Hawaii's mineral output during 1959 was estimated at $6,689,000, an increase of nearly one-half million dollars over 1958. The increase was due entirely to the demand for raw mineral materials by the state's booming construction industry.

IDAHO

Idaho's mineral production started back up in 1959, following a sharp drop in 1958 that reflected decreases in the prices of lead and zinc, two of the state's major mineral commodities, according to Dr. E. F. Cook, dean of the University of Idaho college of mines and the director of the Idaho Bureau of Mines and Geology.

The total value of production in 1959, he said, was $67,109,000, a 4% increase over 1958. Higher values for lead, zinc and phosphate rock offset a sharp drop in cobalt and a decrease in columbium-tantalum. Silver, for the second straight year, was the leader among Idaho minerals, followed closely by lead and zinc.

He said the greatest production increase over the previous year was in Idaho's growing phosphate industry which mined 42% more in 1959 than in 1958. Production of phosphate rock in 1959 was valued at $7.5-million. The

Idaho *(Continued)*

phosphate industry in the state is only 15 years old, Dean Cook said, and its product is already in fourth place among Idaho mineral commodities in value.

He said the mineral production of the Coeur d'Alene mining district increased 11% over 1958 largely because of an increase in the quantity of lead and a 1.2c per lb increase in the average price of zinc. Dean Cook said that with the exception of the Page mine, near Wallace, which worked a four day week from April to August, all major mines in the district were on a five day week through 1959.

Important developments in the mining district for 1959 included a new discovery of lead-silver ore by Bunker Hill Co., increases in the size and grade of orebodies at the Lucky Friday mine and the start of design work for Bunker Hill's new fertilizer plant at Kellogg.

The biggest blow to Idaho's mineral economy during the year, Dean Cook said, was the stopping of cobalt production at the Blackbird mine in Lemhi County (in east central Idaho) when the Government contract was not renewed. Also cited was the decline in columbium-tantalum shipments from the Bear Valley property in Valley County.

Other new developments for the year cited by Dean Cook included plans for sinking a new shaft at the Sunshine mine near Kellogg (the nation's largest silver producing property) to the greatest depth yet reached in the Coeur d'Alene mining district (1720 ft below sea level), construction of a $2-million clay-silica plant near Bovill by J. R. Simplot Co., construction of a new mill and surface plant at the Lucky Friday mine near Mullan, exploration and development of uranium deposits in the Stanley basin area and development of thorium deposits in Lemhi County.

A Lewiston family has received clearance from the U.S. Bureau of Land Management to live on and develop a gold mining claim in the rugged Salmon river country.

The George Wolfe family received word that Edward Woozley, director of the bureau, had reversed a decision made by a BLM examiner after a hearing last spring.

The U.S. Forest Service had objected to the Wolfe family living on and working the gold placer claim along the Salmon river between Campbell's Ferry and Mackey Bar. The opposition was based on the contention that working the claim would destroy a valuable forest trail, that the ground cover would be destroyed and that the site was needed for a helicopter port and recreation site.

Woozley, a former Idaho land commissioner, ruled against the examiner's finding and indicated that the Forest Service action apparently was instigated by school authorities who earlier had threatened and then later withdrew plans for legal action to compel public school attendance by the Wolfe children.

Mrs. Wolfe had taken her seven children into the wilderness site shortly after school opened in the fall of 1958

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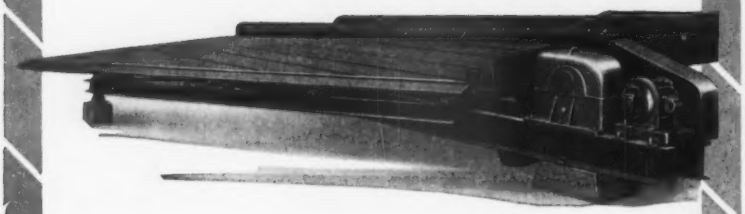

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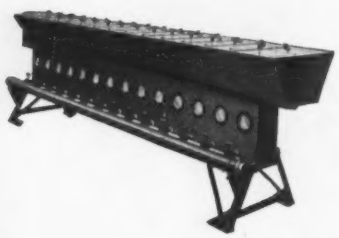

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Idaho *(Continued)*

deciding to teach the children herself instead of sending them to a public school. She stayed with the children in the wilderness cabin during the winter and spring. The family returned from the winderness site last summer and the children are now attending school at Lewiston. However, Mrs. Wolfe indicated that in view of the ruling by Woozley, she intends to take the family back to the Salmon river site in June. Her husband is a railroad employee at Lewiston.

The old Telache silver mine on the west side of Lake Pend Oreille in northern Idaho has been reopened by a group of Sandpoint and Lewiston men.

They reported that since acquiring it a year ago from Telache Lodge, Inc., they have removed about 1,000 tons of rock and dirt from the portal of the main tunnel, retimbered where necessary and installed and tested a pilot mill.

OME, the former DMEA, has announced a contract with the Golden Copper Queen Mining Corp. of Pocatello, Idaho, for financial assistance to explore for copper in Lemhi County.

Hecla Mining Co., Wallace, expects 1959 production to run at about the same level as 1958 but may be slightly less due to several factors. A strike at the East Helena, Mont., smelter of American Smelting & Refining Co. halted shipments of concentrates by Hecla from August to December and production was lower at the Silver Summit property.

Hecla owns about 38% of Lucky Friday Silver-Lead Mines Co., Wallace, and Lucky Friday is expected to show an increase in mine production for 1959. Lucky Friday, the newest major producer in the Coeur d'Alene mining district of north Idaho, expected to complete an $800,000 mill and surface plant near Mullan, by Feb. 1. It will handle up to 500 tpd.

Spokane National Mines, Inc., has purchased the assets of Sunset Mines, Inc., in the Pine creek lead-zinc district of northern Idaho.

Spokane National president George Allison said 500,000 shares of his firm will be exchanged for the 2.5-million shares of Sunset.

The transaction includes some 44 mining claims in the Pine creek district, the old Liberal King mine and a 1500-ton flotation mill. Geological studies are planned in the area and the flotation mill is to be moved to the New Departure silver mine near Bannack, Mont., a property recently acquired by Spokane National along with the Bannack gold mine.

MAINE

Dow Chemical Co. has dropped its option on approximately 400 acres of lithium-bearing pegmatite deposit. Dow had held the tract, on state-owned land for three years, during which time an

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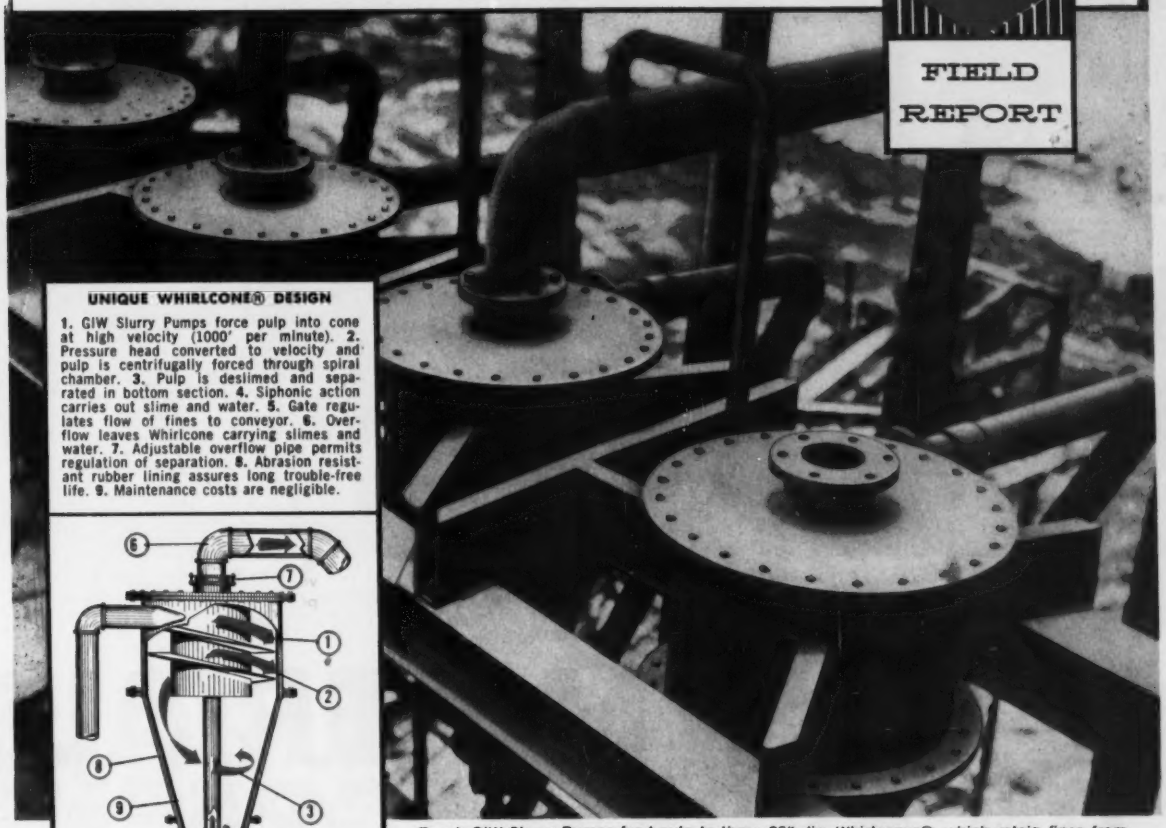
FIELD REPORT



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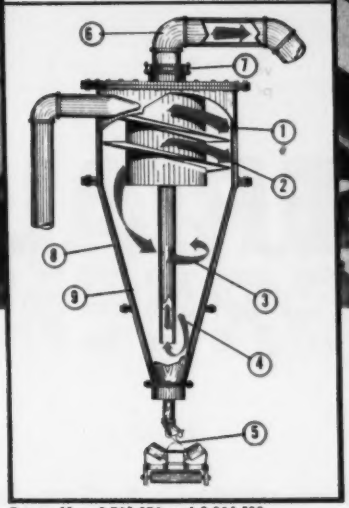
1. GIW Slurry Pumps force pulp into cone at high velocity (1000' per minute). 2. Pressure head converted to velocity and pulp is centrifugally forced through spiral chamber. 3. Pulp is deslimed and separated in bottom section. 4. Siphonic action carries out slime and water. 5. Gate regulates flow of fines to conveyor. 6. Overflow leaves Whirlcone carrying slimes and water. 7. Adjustable overflow pipe permits regulation of separation. 8. Abrasion resistant rubber lining assures long trouble-free life. 9. Maintenance costs are negligible.



Patent Nos. 2,738,070 and 2,806,599

Tough GIW Slurry Pumps feed pulp to these 25" dia. Whirlcones®, which retain fines from classifier overflow. Maximum recovery rate is 20 tons per hour per cyclone. The cones will handle material from −12 mesh to lightest slime.

Whirlcone® Separators solve difficult fine recovery problems.

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GIW's highly efficient Whirlcones® are also being used in the mining fields to deslime, degrit, classify, concentrate, make dam and mine backfill and to dewater or thicken where the overflow can be returned to the process or it can be discarded.

They are available in diameters from 6" to 50". Capital cost including the pump is 20 to 50% of conventional classifiers.

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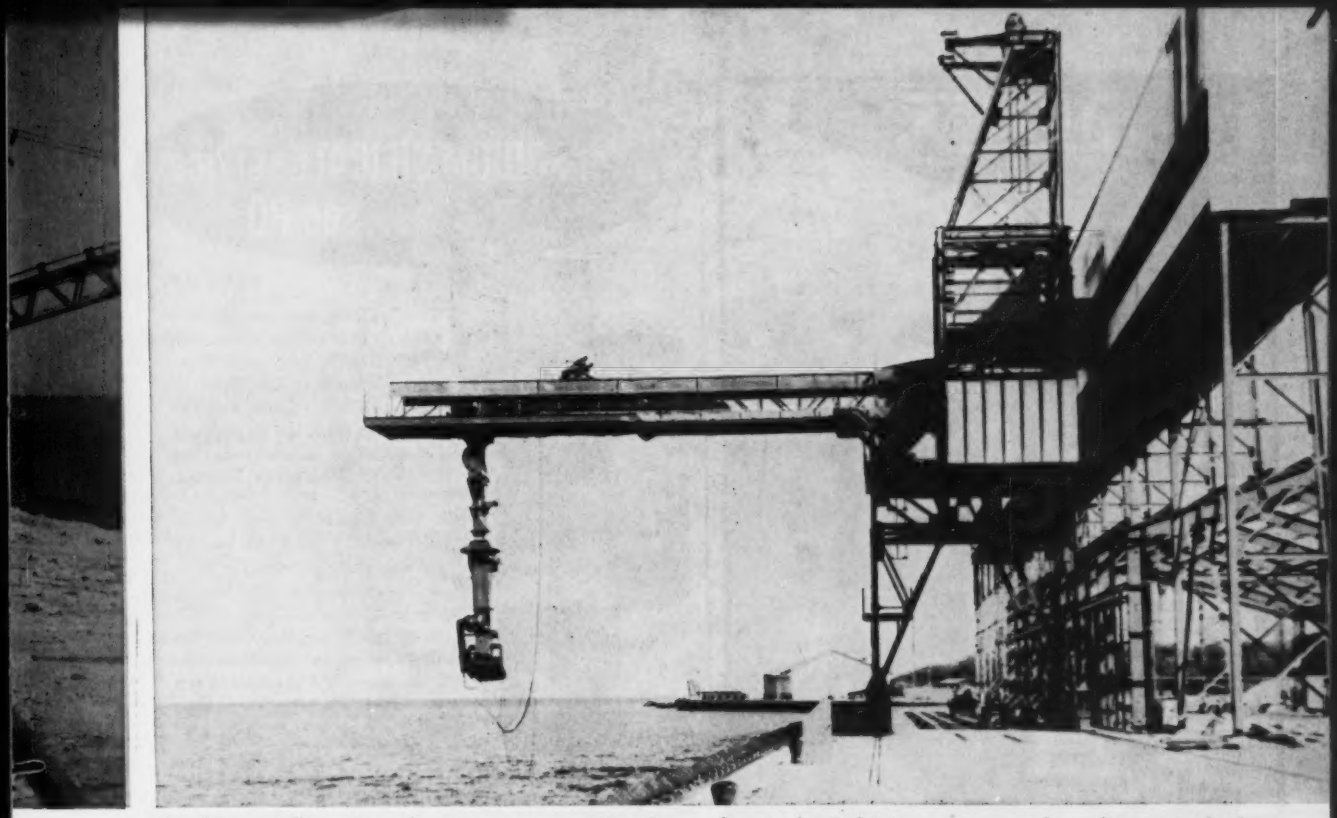

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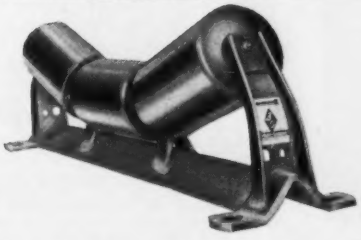

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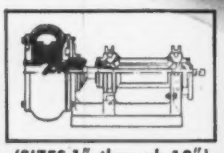

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Over 40 silicates in the PQ line from which you can be sure of getting the right one for your particular ore. The liquids range in ratio of $\%Na_2O:\%SiO_2$ from 1:3.75 to 1:1.60 and the dry forms from 1:3.22 to 2:1. Samples of PQ silicates are available without charge for your laboratory tests.

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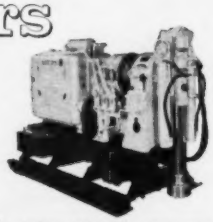
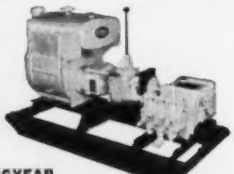


DRILL DEEP HOLES efficiently with a Longyear "44", a high-capacity drill throughout. The heavy duty planetary hoist has ample hoisting and braking power. NW twin hydraulic swivel head. Capacity: 3000 feet of AW rod. Skid or truck mounted.



LONGYEAR variable-volume pumps like this 5-speed 520RQ help increase footage, bit life and core recovery. The driller can instantly adjust volume and pressure over wide range ...and pump into a closed circuit at every stage.

YOUR CREWS CARRY OUT drilling programs *faster* equipped with Longyear core drills. Longyear unitized drill rigs like this one slash moving and set-up time and increase operator efficiency. This Jeep rig consists of a powerful, gasoline-driven Longyear "24" diamond core drill, pump, and truss-type steel mast. Capacity is 675 feet with AW rods. Cab-over-engine Jeep and has 4-wheel drive able to move across roughest terrain.

ADV. 149

Longyear

E. J. Longyear Company, Minneapolis 2, Minnesota
Canadian Longyear Ltd., North Bay, Ontario
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Maine *(Continued)*

extensive mapping and drilling program was initiated. The lithium claim area, in Warren Township, Knox County, is part of a large tract of State institutional land administered by the Maine Mining Bureau.

MICHIGAN

Jones & Laughlin at its research laboratory in Negaunee is testing large samples from its optioned low grade, magnetic ore property near Kirkland Lake, Ontario. The option was taken from Gulf Oil Corp. in 1954.

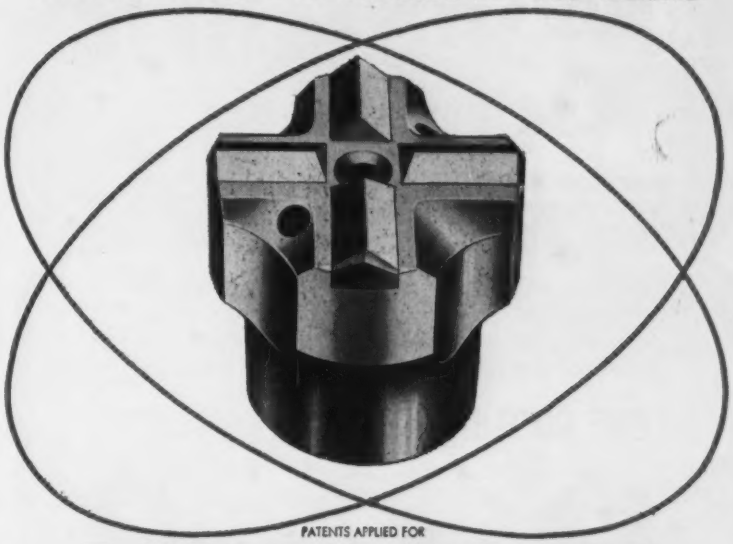
Inland Steel Co.'s Bristol mine, near Crystal Falls, was closed for two weeks beginning Jan. 2 to install new skips and new cables. This was made necessary by the recent 250 ft deepening of the shaft to the 1900 ft level. The mines regular maintenance crew did the work. The Bristol was formerly operated by Oglebay, Norton Co. and closed in 1932 because of the depression. Inland took over the mine in 1948 and began dewatering. It hoisted the first ore a year later. The mine is now operating in ground not previously worked, to produce a red hematite ore.

Humboldt Mining Co., owned jointly by the Cleveland Cliffs Iron Co. and the Ford Motor Co., is doubling the capacity of its plant at Humboldt, near Ishpeming, to be ready during the summer of 1960. Two parallel lines of Allis Chalmers grate-kiln systems are being installed. It will be the first full scale operation of the system to carry out an iron ore agglomeration process for Michigan jasper and is the result of about one year of laboratory and pilot plant testing. Present capacity of the plant is 1,000 tpd of specular hematite concentrates. Since the iron content is nonmagnetic, the concentration procedure includes a flotation process. The 60% plus concentrates will pass through two 9x30 ft balling drums. The balled concentrates (⅜-in to ⅝-in) will pass over specially designed vibrating screens and all undersize material will be returned to the feeders. The balls will be preheated on a travelling chain type of grate from which they will be discharged into a 10x120 ft rotary kiln. The balls will be cooled in a 25 ft diameter annular cooler, planned for heat recovery from the pellets. By having the entire system connected and enclosed, hot kiln exit gases are caused to make two separate passes through the bed of incoming balls and thus transfer the heat needed to harden the balls.

Copper Range Co. has drilled a property a short distance west of the White Pine mine. It is believed the value of the new ore body could be substantial. An exploratory shaft is being sunk as a further check on drilling results.

Lake Superior & Ishpeming Railroad Co., a subsidiary of the Cleveland-Cliffs Iron Co., shipped 2,510,943 tons of iron ore from its dock at Marquette in 1959.

DRILLING BENEFITS THAT ATTRACT MINING AND CONSTRUCTION USERS



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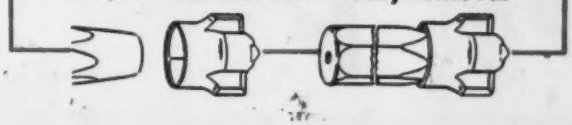
The exclusive, shallow, long-life inserts of the TEE CEE BIT need no resharpening. LIDDICOAT design precludes the reverse taper dullness common to conventional bits and gives TEE CEE BITS a fast and effective drilling life lasting far beyond the point where conventional bits must be withdrawn from service for sharpening.

The bodies for LIDDICOAT Bits are forged from nickel alloy steel. The tremendous pressure which extrudes the desired shape retains the important grain of the steel . . . flow lines being compressed rather than cut across as is usual in forgings of this type. The compression of the material and retention of the unbroken flow lines give LIDDICOAT Bits unusually strong structure.

New taper socket — no threads
fast, firm attachment — easy removal



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Michigan *(Continued)*

As usual the Mather "A" and Mather "B" mines of Cleveland-Cliffs were among the heaviest shippers. Humboldt Mining Co.'s pelletizing plant at Eagle Mills shipped 237,052 tons of pellets and 1589 tons of pellet screenings. The screenings were only .67% of the pellet tonnage.

Jones & Laughlin's Tracy mine at Negaunee shipped 347,725 tons in 1959 compared to 350,723 tons in 1958. The Tracy made its first shipment of 63,447 tons in 1955. The shaft at the mine is 1560 ft deep.

MINNESOTA

M. A. Hanna Co. has a busy winter program planned for its Mesabi and Cuyuna range mines. At the Pierce mine in Hibbing, work is proceeding on the plant which will treat the ore which is not direct shipping. It will include heavy media, cyclones and spirals. Stripping is also being carried on. The Mississippi group at Keewatin will also be busy. Included in the stripping program in this area will be the Sargent mine, heretofore an underground mine operated by International Harvester Co. from 1919 to 1945 and by Cleveland Cliffs Iron Co. 1947 to 1957. The Sargent has shipped more than 6-million tons and has about 3.5-million tons remaining. It will be converted to open pit mining.

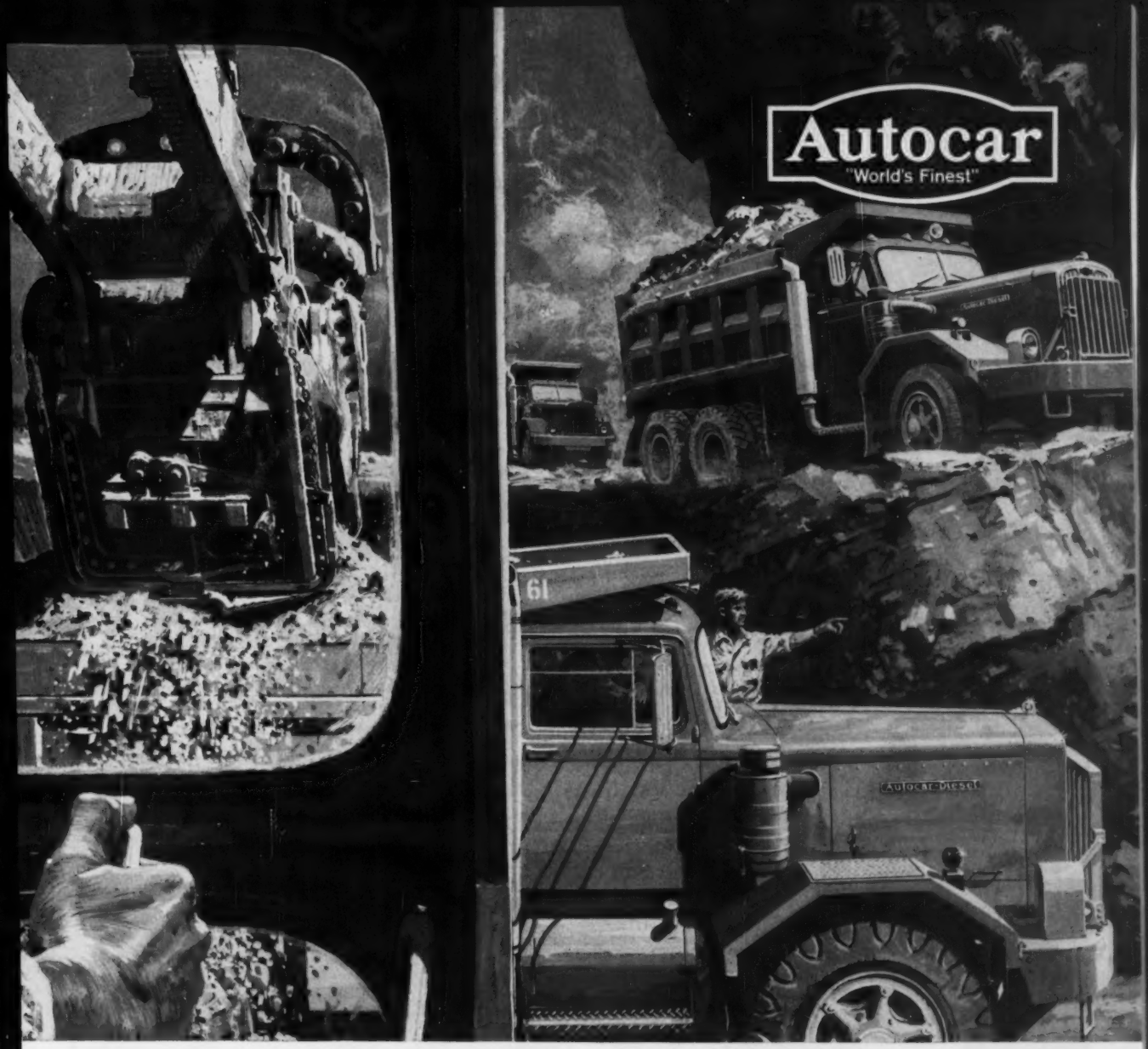
The Hunner mine at Coleraine is stripping and relocating its screening plant in the pit. The Hunter made its first shipment in 1956 and has produced nearly 3-million tons to date with about 5-million tons remaining. Other stripping operations are being conducted at the Douglas mine near Chisholm, the Cooley group, and on the Cuyuna range.

Jones & Laughlin Mesabi range mines are preparing for the 1960 season by winter stripping at the Schley mine at Gilbert, the Longyear at Hibbing, the Hill-Annex at Calumet and the Lind-Greenway between Coleraine and Grand Rapids. The Greenway was operated by Evergreen Mines Co. 1940 to 1944 and shipped 868,449 tons. The Lind may make its first shipment in 1960.

Snyder Mining Co., in 1959, shipped 442,043 tons from its Webb, Whiteside and Godfrey mines. The Godfrey is the only operating underground mine in the Hibbing area. For 1958 the three mines shipped 331,424 tons.

Erie Mining Co. closed its shipments from Taconite Harbor in mid-December, and began all-rail shipments to the Interlake Iron Corp. at Chicago. It is shipping about 750 tpd of pellets and expects to continue until from 120,000 to 125,000 tons have been moved. Erie has shipped about 4-million tons during the 1959 season.

Reserve Mining Co. shipments of pellets from Silver Bay ended on Dec. 14 when



Job for Autocars—A truck is a production tool, and tools must match the job—like the Autocar ten-wheelers shown at work here.

Peak production calls for Autocar ..."nothing less"

It doesn't pay to mince words. When your shovel piles on a yard more every time—when the floor is rough, rocky or difficult—when you can't afford a slowdown in the hauling cycle—*you need an Autocar.*

And *only* Autocar *fully* custom-engineers each truck to fit the job... your assurance of top performance.

Autocar's great load capacity, power and stamina are the result of the way Autocars are built—with unequaled precision and quality.

Where the jobs are tough and schedules tight, Autocars are an absolute necessity. If you settle for less, you'll *get* less—so why try to get by without the "World's Finest"?

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**Be sure your Maintenance Superintendent and Welding Foreman get this important news. Show them this announcement.*

Here's a manganese electrode with improved ductility in weld deposits, freedom from cracks and excellent, overall weldability! Deposits possess full austenitic manganese work-hardening properties, matching manganese base metal, and provide physicals unexcelled in the industry! You'll find these new electrodes "tops" both for *joining* of parts and *buildup* of worn areas on all manganese steel equipment.

STABLE ARC—Unusual arc stability is insured by extruding a concentric alloy coating around a solid wire core. The arc runs smooth as silk with freedom from popping and spatter.

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WHY WAIT? Check the unusual welding properties of this new, *better* manganese electrode today! Compare it with every other manganese electrode you've *ever* used... you'll agree it's the best in the field! Your Stoody dealer will be glad to have you test it on your own job!

PHYSICAL PROPERTIES:

(Based on tests by independent laboratory)

	DC Straight Polarity	DC Reverse Polarity
Tensile Strength	119,000 psi	111,000 psi
Yield Strength	67,000 psi	66,000 psi
Elongation in 2"	55%	37.5%

Hardness—Single pass on manganese steel; as deposited—15 Rc, as work-hardened—48 Rc.
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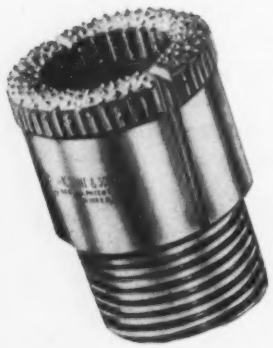

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First In Experience and Service

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Murray Hill New Jersey

Minnesota *(Continued)*

the Thomas Girdler took on the last load. Reserve's total 1959 shipments were 3,603,000 tons of pellets compared to 4,994,174 tons in 1958. Total shipments by Reserve to date have been over 19-million tons. The company has no present plans for all-rail shipments during the winter.

The W. S. Moore Co. of Duluth shipped 223,187 tons from its Mesabi Range mines in 1959: The Judson, Judson Extension, Mariska (largest producer, 160-242 tons) and the Norman. The 1959 tonnage exceeded the 1958 shipments by only 1454 tons.

The Duluth-Superior harbor closed officially on Dec. 23. The steamer Lindabury of the Pittsburgh Steamship Division, U.S. Steel, entered the harbor at 6 am and will be wintered there. This is the latest commercial closing of the harbor on record, the former record being on Dec. 22, 1909. Army engineers' records go back to 1871.

MONTANA

In Montana the big mining news was the copper strike which has affected operations in Anaconda, Butte, East Helena and Great Falls. The Anaconda Local 117 of the International Union of Mine, Mill and Smelter Workers entered into a separate contract with the Anaconda Co. putting the Anaconda smelter back into operation. The first copper matte in 151 days was poured on Jan. 4.

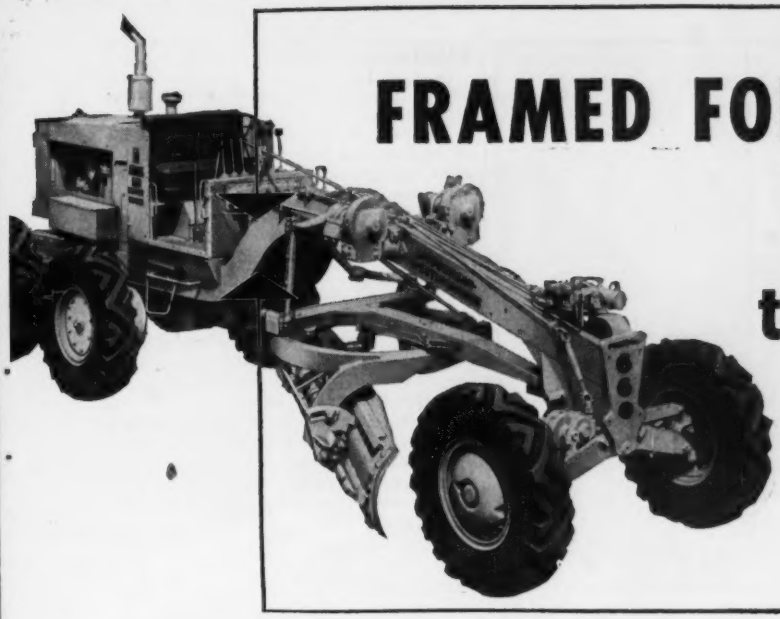
The Emma Mine, a manganese producer, was purchased by the Anaconda Company to "consolidate its holdings" in Silver Bow County. The gold dredge at Jefferson City, a famous area landmark, has now ceased its operations. Minerals Engineering Company, Dillon, has announced resumption of its tungsten operations with a force of 40 men. These activities were curtailed about 1½ years ago. The Mariette Mine, 15 miles west of Townsend has installed a 200-tpd flotation mill. This is a gold producer.

The 1959 value of all mineral production in Montana declined to $168-million. This represents a decline of about 5% ($8.7-million) from 1958. The figures are from a preliminary USBM estimate. The closure of Anaconda operations because of the strike caused the principal loss.

Production of aluminum in Montana increased somewhat over 1958. The Anaconda Aluminum Co. at Columbia Falls operated at 75% of capacity to August. Capacity was subsequently raised to 88%.

The value of copper produced in 1959 was better than $40-million compared with better than $65-million in 1958.

In 1958, other minerals had a value of $20,318,000 whereas 1959 saw the figure fall to an estimate of $17,657,000. **GSA is going ahead with plans to sell,** and thereby eliminate the Government



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...to give you top performance on haul road maintenance

A strong, stable blade-foundation is essential if a grader is to give you high output. That's why LeTourneau-Westinghouse Adams* graders are given rugged, solid-strength, one-piece frames... that take all of the shocks, twists, and stresses of hardest day-to-day operating conditions.

Continuous-welded... front to rear

Front-to-rear members of the L-W main-frame are heavy steel U-channels. Up front, two full-length channels are welded together to form a box section. Channels separate at top of arch and become two boxes by addition of two heavy steel plates. Frame is continuous-welded from front bolster plate to boxed-in rear-end.

One major advantage of this boxed-channel framing is that it provides *maximum strength without excessive weight.* Result: with the L-W grader, more weight and strength can be built into important components, such as the big 63" L-W circle... none bigger in the industry... where size and strength mean better performance.

Steady blade-mount

This unique L-W main-frame also provides a stable mount for the blade. No matter how tough the going, its solid strength assures a big bite... a smooth, precise finish-surface. No faltering when the blade hits heavy loads or hard-pan... no "riding-up", or deflection.

Operator has clear view of blade

With circle-lift controls mounted forward on frame, both ends of blade are clearly visible to operator, *whether he's sitting or standing.* Clear view of blade assures more accurate grading... and more work done each day.

7 models... 67 to 190 hp

Let us show you any of the 7 high-speed LeTourneau-Westinghouse graders in action. We'll prove to you how these machines can grade faster... more accurately... at less cost. Ask for details and demonstration.

Unique, box-type, L-W Adams one-piece frame runs from front to rear without sharp bends... without joints... without breaking points. Seventy-three years of grader experience have gone into the development of this frame. It's the foundation for L-W grader's rigid, smooth-cutting qualities that get more work done fast... at lowest cost.

*Trademark G-1955-MQ-1

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

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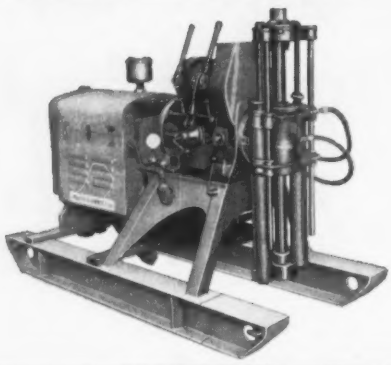

IT'S AN S&H MODEL 40-CL

We've heard this phrase over and over again from our many customers. They know that it is unsurpassed for foundation investigation, mineral exploration, and grout hole drilling.

THIS IS WHY THEY BOUGHT A 40-CL

- **STABILITY** — Wider, longer skids and a sturdy steel frame make it very difficult to tip even when moving in mountainous terrain.
- **DEPENDABILITY** — The heavy-duty wire line hoist coupled with a rugged power unit offers more hoisting power than you'll ever need at the rated capacities.
- **ADAPTABILITY** — The choice of . . . power units, screwfeed or hydraulic swivelheads in varying spindle sizes, four transmission speeds and the availability of a side-mounted cathead and a built-in retracting mechanism makes the 40-CL adaptable to most drilling jobs.
- **MOBILITY** — The 40-CL has a built-in set of sheaves to facilitate movement under its own power. In addition a low-bed trailer is available that permits the use of the rig directly from the trailer mounting in locations where the terrain permits.
- **QUALITY** — Careful machining and time-tested inspection methods substantially increase the trouble-free drill life.

If you want a machine for truck mounting, ask about our 40-C TRUCK-MOUNT. When you want an "all-round" core drill machine, remember that the 40-C and 40-CL Core Drills are just the machines for you.

Look for our emblem... It's your Seal of Quality

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Montana *(Continued)*

section of the Butte area manganese plant.

The sale of the Government portion of the Domestic Manganese and Development Co. property on South Montana has been advertised. The ads called for sale of Government surplus real property with sealed bids to be received at the GSA offices in the Federal Building in Seattle Jan. 18.

The Government-owned property in the Butte plant includes a flotation mill and crusher building including crushing, grinding and flotation machinery and equipment for the concentration of low-grade manganese ore.

John Cole, president of the Domestic Manganese and Development Co., said that company's property is not for sale. A part of it already has been leased to the newly formed Rocky Mountain Phosphates Co.

NEVADA

During 1959 Nevada's mining industry made a definite comeback from the blow it suffered the year before when the state's big tungsten mines and mills closed.

Taking new places in mining importance, iron, gold and silver assumed big proportions along with copper. Numerous small operations sprang up to replace the few big ones which were closed, and as a result 4,750 men were employed in Nevada mines during 1959 as compared with 4,150 during 1958. Mining operations increased from 97 in 1958 to 110 in 1959.

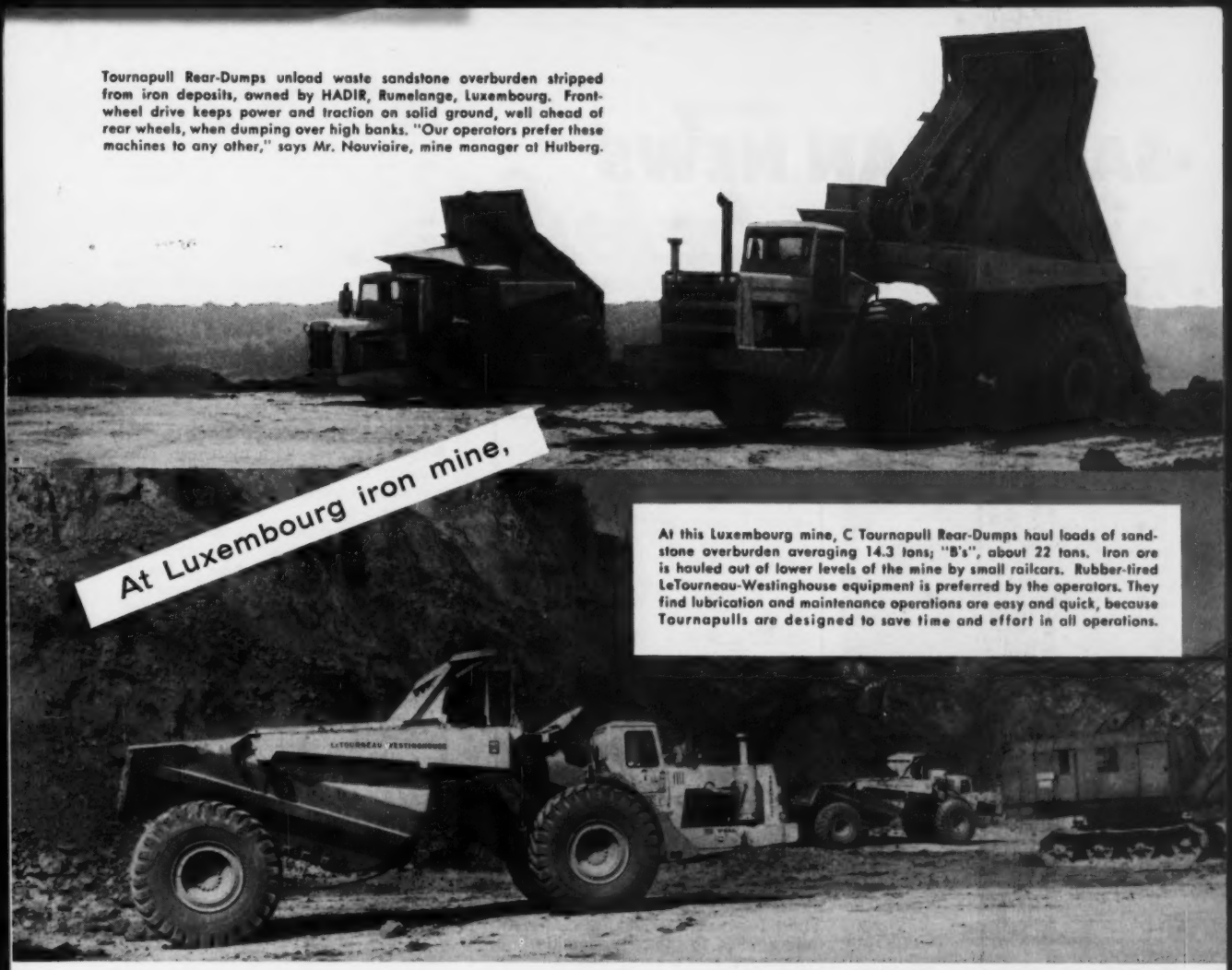
During most of the year more than 20 Nevada gold mines were employing upwards of 250 men and were producing 14,000 oz of the precious metal every month. It was a large increase from the year before. Iron ore was produced at a rate of 60,000 tons per month and at year's end the total had far exceeded the 1958 output of 594,000 tons.

Kennecott Copper Co. operations in White Pine County remained the state's largest. Early in the year 160 men were added to the payroll and later a skip haulage system was installed at great expense in the firm's Liberty Pit. A strike which lasted from August to December cut down the state's copper output for the year, although Anaconda's big plant at Weed Heights in Lyon County continued without interruption and stockpiled 10,000 tons of precipitate during the walkout period.

Production of nonmetallics remained at a high figure throughout the year and furnished employment to 1,250 men.

The Cordero mine in Humboldt County maintained its place as one of the nation's top mercury producers by going deeper after new ore reserves. Later in the year the firm suffered a $150,000 loss when the mine's power plant was destroyed by fire.

Largest investment in Nevada mining was made by the Eagle Picher Co. which completed a $2.5-million plant in Pershing County for treating diatomaceous



Tournapull Rear-Dumps unload waste sandstone overburden stripped from iron deposits, owned by HADIR, Rumelange, Luxembourg. Front-wheel drive keeps power and traction on solid ground, well ahead of rear wheels, when dumping over high banks. "Our operators prefer these machines to any other," says Mr. Nouviaire, mine manager at Hutberg.

At Luxembourg iron mine,

At this Luxembourg mine, C Tournapull Rear-Dumps haul loads of sandstone overburden averaging 14.3 tons; "B's", about 22 tons. Iron ore is hauled out of lower levels of the mine by small railcars. Rubber-tired LeTourneau-Westinghouse equipment is preferred by the operators. They find lubrication and maintenance operations are easy and quick, because Tournapulls are designed to save time and effort in all operations.

HADIR replaces trucks with Tournapulls®, increases production, reduces maintenance

HADIR, large European steel producer, has made two major changes at its Hutberg, Luxembourg, iron mine. It has broadened its operations to include open cast as well as underground mining. And, during the last several years, the firm has gradually replaced its trucks with LeTourneau-Westinghouse Tournapull Rear-Dumps.

By making these changes, according to HADIR officials, the mine will achieve greater production at comparatively lower cost. Regarding the Rear-Dumps, mine manager Mr. Nouviaire reports that "they have reduced maintenance costs and produce more."

6,600 tons per day

Production records of the 8 LeTourneau-Westinghouse machines at the mine confirm Mr. Nouviaire's report. Loaded by two 3½-yd shovels, the Rear-Dumps move 6,600 tons of overburden per 15-hour day. This excellent production is averaged on round trips 5,250 feet long, with 5% grades over half of the haul distance, and on soft roads that become very slippery when wet.

Two of HADIR's Tournapulls are Model "B's" with 35-ton capacities; six are Model "C's", able to carry 22 tons. Tournapull Rear-Dumps are also built in a third size, the Model "D", with 11-ton capacity.

On the biggest mine and quarry operations all over the world, you will see fast, efficient LeTourneau-Westinghouse equipment at work. Ask us for complete information.

BR-2073-MJ-1

LETOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

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SAUERMAN NEWS briefs

SAUERMAN BROS., INC.,
626 South 28th Avenue, Bellwood, Illinois
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Stockpiling Zinc Residue

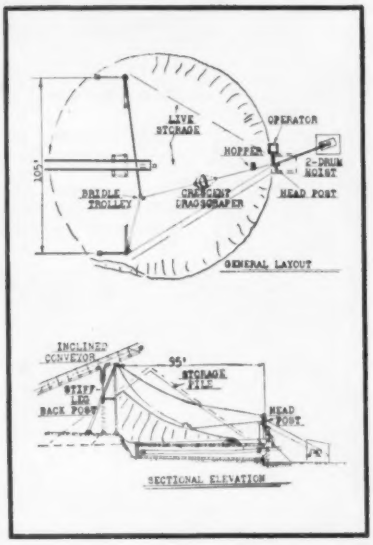
Zinc residue from the smelting furnaces of the Meadowbrook Corporation is economically handled by a DragScraper storage machine. About 100 tons of residue are produced daily in the refining processes and the material is carried by belt conveyors to the disposal area. The conveyors feed a swivel spout which forms the initial pile near the head post.

Ample storage capacity is provided by using an elevated bridle system at the outboard side of the disposal area. The elevated bridle cable is supported by two 60-ft. guyed masts about 200 ft. apart. Lateral shifting of the DragScraper is readily accomplished by power-shifting the trolley and tail block to a new position on the bridle cable. The height of the mast permits building a 50-ft. high pile and provides storage for 100,000 yds. of zinc residue for each setup of the tailmasts.

(Condensed from Sauerman News No. 152.)

Reclaiming Material to hopper from all sections of a 500-ft. warehouse, the estimated operating cost of this DragScraper Machine is 2.1 cents per ton. *(Sauerman News 145).*

Rapid Shifting DragScraper is Engineered to Needs of Silica Sand Producer



The Sauerman Method was successfully applied to the requirements of a prominent silica sand producer, as shown in the drawing above. This Rapid-Shifting DragScraper Machine reclaims raw sand from a 6,000-ton stockpile.

The pile is formed by an inclined conveyor leading from the floor of the quarry to the live storage area. The Crescent DragScraper reclaims from storage to a hopper-fed conveyor in front of the head post.

Before the DragScraper was installed, the raw sand frequently bridged across the hopper. Such interruptions in the flow of raw sand to the plant resulted in costly shutdowns. The Crescent prevents this bridging action and provides a steady flow of material for processing.

The Sauerman Method also permits the company to build up a reserve pile of raw sand sufficient for at least one week's production as insurance against a quarry shutdown.

(Condensed from Sauerman News No. 147.)

MORE NEWS AND INFORMATION

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Nevada *(Continued)*

earth. During much of the rest of the year the plant remained idle while management sought markets for its output.

Largest mine deal of the year was purchase of the Lowboy Uranium claims by White Caps Gold Mining Co. for $350,000. The property lies in the vicinity of Austin and with the Apex mine, also near Austin, produces all of Nevada's uranium ore.

Greatest influence in reviving mining activity in central Nevada was the U.S. Milling & Minerals Corp. whose mill revived the town of Silver Peak, and created new activity in the Ohio mine at Gold Point and in other properties at Goldfield, Tonopah, and Virginia City. Belmont, a long dormant ghost town, came to life when Belmont Mines Co. moved in to reopen the El Dorado South property.

A major mishap in Nevada's mining year was the death of three men in a cave-in at the Mohawk mine in Esmeralda County during October, and the major shutdown came at the year's end when Round Mountain Gold Dredging Co., the state's largest gold producer, ceased operations in Nye County, turning 131 men out of work.

Important discovery of non-metallic deposits was made during the year in Clark County, and important gold strikes were made at Gold Point in Esmeralda County, near Midas in Elko County, and in the Tonopah area.

Iron ore shipments from the Mineral Basin area of Pershing County totalled 450 cars during December, most of it going to domestic markets. Principal producers were Dodge Construction Co., Mineral Materials Corp., Nevada Iron Ore Co., Rowe & Austin, Segerstrom & Heizer, and Ray Helmke. The Iron King mine in Humboldt County shipped large tonnages to Youngstown Sheet & Tube mill at Gary during the month, and Standard Slag Co. shipped large amounts from its iron mine in Douglas County. USBM officials have estimated that iron ore shipments from Nevada during 1959 will top the 1958 total despite the fact that Japan has reduced its purchases from the U.S.

The Tonopah King mine operated by U.S. Milling & Minerals Corp. is producing very good silver-gold ore from a 12-ft wide vein in the winze which was discovered during December. The operation employs 13 men, and ore is hauled to the company's mill at Silver Peak.

Production of good gold-silver ore from the Tonopah Divide Co. property six miles south of Tonopah is now underway from the 400-ft level. Extensive development work was completed during December with the installation of power lines transformers, hoist, compressors, and cables. Underground water and air lines were installed and mine rails extended. The shaft was opened to the 1,000 level. Tests are being run at the U. S. Milling & Minerals mill at Silver Peak to see if successful recovery can be made. Jim Smith, of Tonopah, is general superintendent of the operation.

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In less than 4 minutes, a fast LeTourneau-Westinghouse Tournatractor® drives a mile to your next job. This mobile 17-mph LW tractor travels anywhere under its own power — via highway, or cross-country.

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LW Tournatractor has anti-friction bearings throughout... with sealed-in lubrication to protect against weather, dust, and wear. What's more, this rubber-tired tractor has far fewer moving parts and far fewer exposed parts than crawlers, so all phases of maintenance — from inspection to lubrication — are greatly simplified, to save you money.

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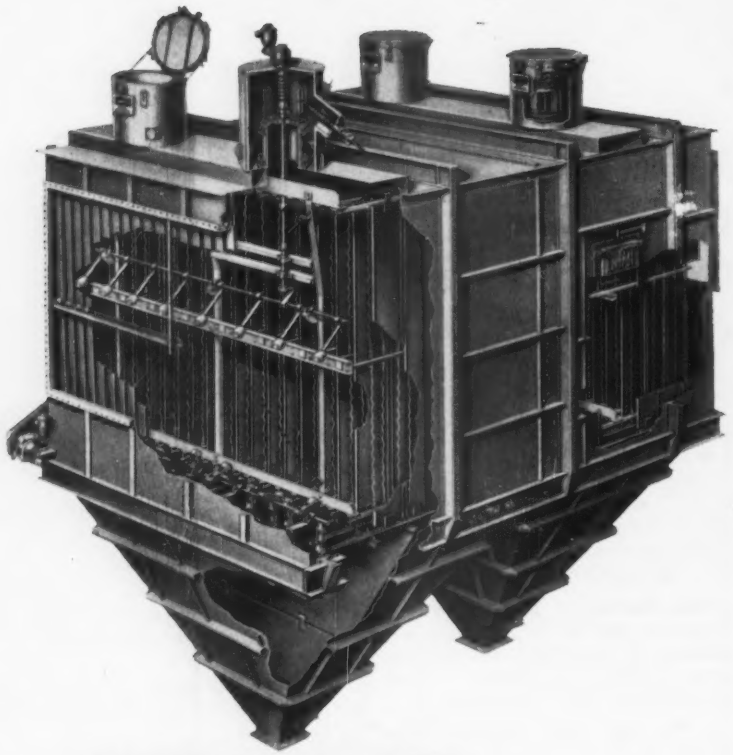

DECADE
OF OPERATION PROVES MAINTENANCE OF BUELL 'SF' PRECIPITATORS AVERAGE LESS THAN 2%

In 10 years of selling 'SF' electric precipitators, the number of replacement parts ordered from Buell has amounted to only 1.17% of the total sales! Even on emitting electrodes, usually the most vulnerable part of a precipitator, replacement has amounted to less than 1% of the original number installed. What do these extremely low percentages mean? Exceptionally low maintenance costs, for one thing, continuous high-efficiency operation, fewer shutdowns and process interruptions. Buell self-tensioned emitting Spiralectrodes eliminate vibration found in weight-tensioned wires. Buell's low maintenance precipitators will provide you with the most satisfactory operating results. They're backed by 25 years of experience in dust collection, with the practical know-how gained on hundreds of installations. Write for descriptive literature. The Buell Engineering Co., Inc., Dept. 19-B, 123 William St., N. Y. 38, N. Y. (Subsidiary: Ambuco Ltd, London, England)

EXPERTS AT DELIVERING EXTRA EFFICIENCY IN DUST RECOVERY SYSTEMS

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Nevada *(Continued)*

Initial public hearings on creation of the Great Basin National Park southeast of Ely, are believed to be the first encounter on plan of National Park Service to withdraw an estimated 14-million acres from the public domain.

The sessions at Ely on legislation sponsored by Senators Alan Bible and Howard Cannon and Rep. Walter Barring, all Nevada Democrats, disclosed a new unity among forest, mining, agricultural and recreation interests in favor of multiple use.

Pitted against these interests were supporters from the National Park Service and a group of Ely businessmen who hope for new tourist trade.

Of 143 statements and appearances, 90% were opposed to creation of the 147,000 acre park which would surround Mt. Wheeler and the Mt. Washington Mining District where Beryllium Resources, Corp., Salt Lake City, has made a major discovery of disseminated beryllium ore.

Appearing against the bill were W. Howard Gray, chairman of the public land committee of the American Mining Congress and Louis Gordon, vice president of the Nevada Mining Assn., both of Reno; J. C. Kinnear, Jr., general manager, Nevada Mines Division, Kennecott Copper Corp., Floyd Iverson, Ogden, Utah, chief forester for the Intermountain Area; James D. Williams, Mt. Wheeler Mines, and discoverer of the beryllium deposit, Salt Lake City; Norman C. Williams, vice president and chief geologist, Beryllium Resources, Inc., also of Salt Lake City; Bruce W. Odlum, Inyo, Calif., president of Beryllium Resources.

NORTH CAROLINA

W. R. Atkins, manager of the Tungsten Mining Co. mine in Vance County, which was closed two years ago when the Federal Government stopped stockpile buying of tungsten, announced Dec. 28 that the mine was to be reopened.

He said a hoist has been purchased from the Stanrock Uranium Co. of Elliott Lake, Ontario, and will be installed at the Sneed shaft. The present hoist at the Sneed shaft will be transferred to the central shaft, where a hoist which has been in use will be discarded.

Some two months will be required to make the changes, Atkins said, and actual production will begin in April.

OME has approved a contract with P. K. Associates, Inc., of Baltimore, Md., for the expenditure of $33,620 on exploration for mica in Macon County. The company and the government will split the exploration cost evenly.

OREGON

Estimated Oregon mineral production of $39.6-million in 1959 was a sharp drop off from a valuation of $45.2-million in 1958.

Bethlehem contact men move fast, talk sense, work right alongside you

Here, one of our teams tests the anchorage capacity of a Bethlehem Roof Bolt assembly. If you're interested in learning more about roof bolts, remember that our men are ready to do a lot more than just talk. They'll help you with the original installation and testing of mine roof bolts and accessories. Just let us know where and when.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

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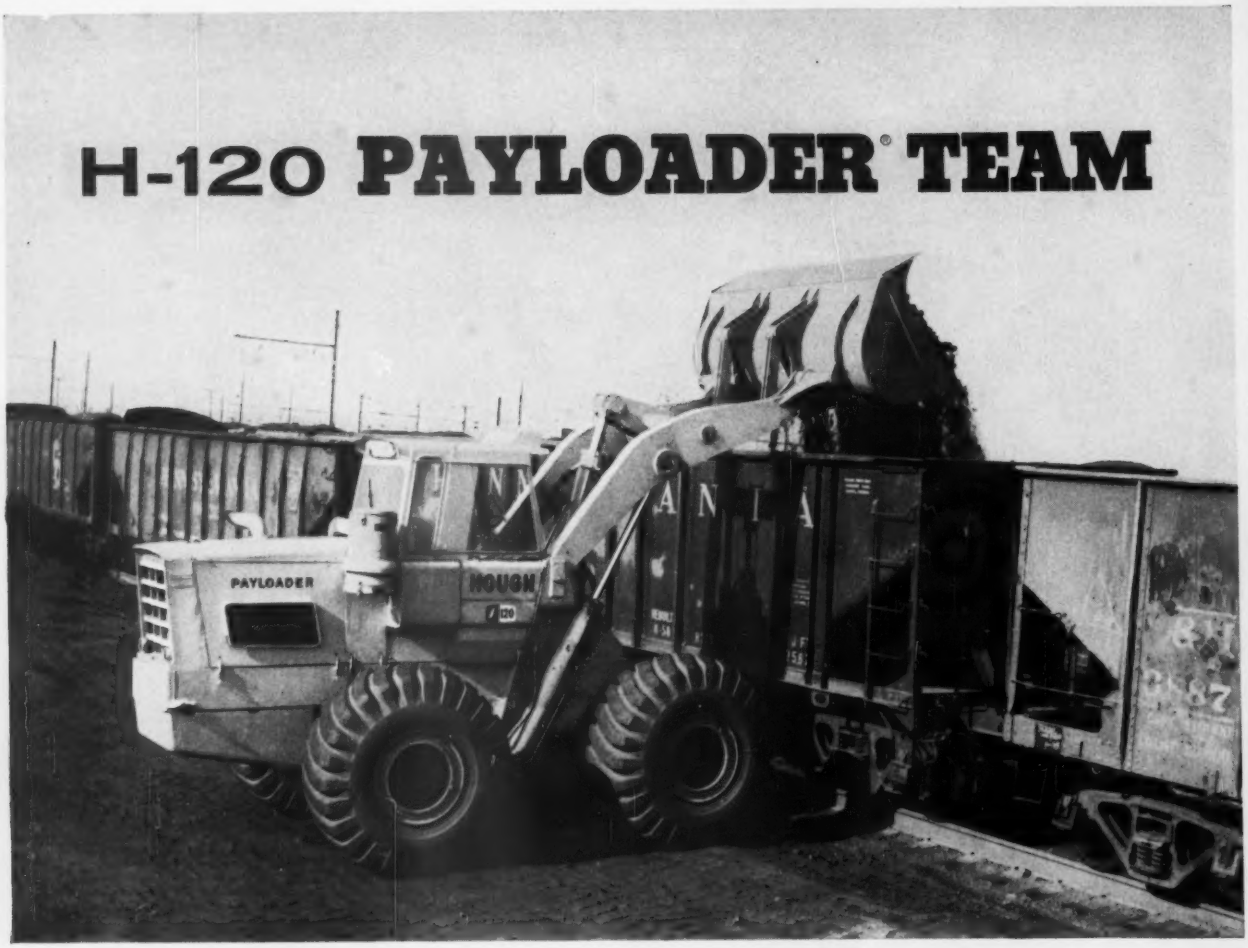
H-120 PAYLOADER® TEAM



4 Huge Model H-120 "PAYLOADER" Units Were Selected For The Job

"The better balance, speed and maneuverability of the H-120 makes it a better buy than larger competitive models tested on this job," says Charles E. Young, Job Superintendent.

SPEEDS ORE-HANDLING OPERATION

for Armour Excavating, Inc.

Armour Excavating, Inc. is one of the contractors that has expanded its operations into the ore-handling field. Its share of such work has increased with the rapid growth of the Port of Philadelphia as an important iron ore handling center.

The Pennsylvania Tidewater Dock Co., at Pier 122 South, has a 4-crane ore dock capable of unloading 6,000 tons of ore an hour, which the Pennsylvania Railroad transports in cars to a number of steel mills in this part of the country. They have areas available for the ground storage of between 3 and 4 million tons of ore, the ground having been previously prepared by Armour.

One phase of Armour's ore-handling work consists of loading railroad cars with the various types of ore which have been stockpiled along miles of track. This work has been greatly expedited by the recent purchase of 4 Model H-120 "PAYLOADER" units from M-W EQUIPMENT CO., Division of Metalweld, Inc.

These "PAYLOADER" units pick up the ore from the stockpile, carry it to the track and load it directly into railroad cars. Their speed and mobility enable them to travel over this site in a few minutes. In addition, they move loaded cars along the track and bring in empty cars to be loaded. No other equipment is needed for this entire operation.

Joseph Keenan, an operator, says, "I like the H-120 better than anything I've run. It's faster, comfortable and easy to handle. The balance is perfect and the safety and visibility is tops, because of the lift arm design. The high lift and long reach let me center the loads in the gondolas as the railroad demands with this heavy ore."

The Model H-120, conservatively rated at 12,000 lbs. operating capacity, is the largest of the "PAYLOADER" line of 20 models in 8 capacity ranges. Your Hough Distributor with his complete parts and service facilities, backed by Hough field service personnel, invites your inquiry. See him today.

The "PAYLOADER" units need no 'dozer or other assistance in the loading operations, because they also do their own towing and car spotting, dozing, stockpile trimming and clean-up work.

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Company.....
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City.....State.....
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Only REPUBLIC Mine Roof Bolts Offer These 5 CERTIFIED-PERFORMANCE

1. PRECISION-TAPERED PLUG

Expertly engineered for proper shell expansion. Angle of taper is at the precise degree required for strength, dependability, and quick efficient tightening. Whether in relatively soft formations or other types of rock strata, improved Republic Mine Roof Bolts assure best performance.

2. HEAVY-DUTY SUPPORT NUT

Square nut gives over 40% better support than even the best previous method, yet maintains correct bolt tension by stripping at approximately 50 pounds torque with no damage to bolt threads. Nut can be easily applied either side up —another plus feature.

3. MATERIAL CONTROL CERTIFICATE

Included with every shipment of Republic Roof Bolts is a certificate stating specific physical properties of the steel used. Data provided: yield point in pounds per square inch, yield and break point in pounds, and steel heat number. No guesswork about the quality you get from Republic.

MINE ROOF BOLT MATERIAL CONTROL CERTIFICATE

Republic Steel Corporation hereby certifies that the mine roof bolts included in mill order number _____ were made from the following steel:

HEAT NO.	YIELD POINT (PSI)	YIELD POINT (POUNDS)	BREAK POINT (POUNDS)

The above figures are record as contained in the official records of the Corporation.

BY _____
CHIEF METALLURGIST BOLT AND NUT DIVISION

REPUBLIC STEEL CORPORATION
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FEATURES

4. HIGH-STRENGTH, ALL-PURPOSE EXPANSION SHELL

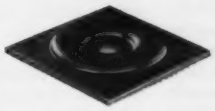
New, improved Republic RS-1 Expansion Shell is designed for effective use in any type of strata. Wide, strong leaves and flaring inside taper mean extra holding power in relatively soft formations. Narrow base supports for the leaves assure easy expansion and a wedge-like grip as the anchor is tightened.

5. IMPROVED SELF-CENTERING HEAD

Compact, one-piece head eliminates need for separate washer. The heavy flange and thick, reinforced washer are guided cleanly and firmly into position in the bolt plate. Entire unit is forged, for ruggedness and strength. Standard 1⅛" head available with ¾" and ⅝" bolt sizes.

Available Pre-Assembled to Cut Your Installation Costs

You can order your Republic Certified-Performance Roof Bolts fully assembled to save you assembly costs, prevent loss of parts and damage to bolt threads. Remember to specify Republic Roof Bolt Plates, too.



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REPUBLIC ELECTRUNITE® GROOVED-END TUBING offers cost-saving, time-saving advantages for many mining applications. Quickly and easily joined with Victaulic Couplings, rugged Grooved-End Tubing is ideal for air, water, drainage lines, and other heavy duty operations. Can be taken up and relaid as needs change. Send coupon for more information.

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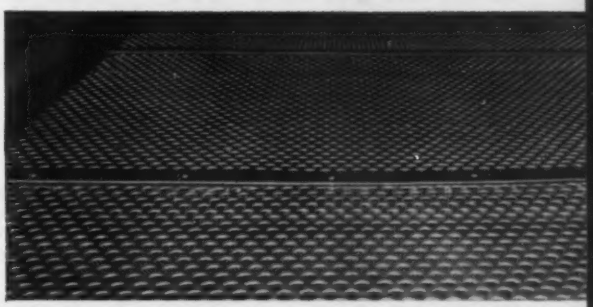

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City_____ Zone____ State_____

Oregon *(Continued)*

The 12% decline reflected substantially smaller values for stone and cement with other non-metals remaining close to the 1958 level.

Increased production at the White King uranium mine of the Lakeview Mining Co. in Lake County offset declines in chromium and mercury production in the metals column.

Lakeview Mining Co.'s milling facilities were completed in November 1958. First quantities of ore processed were from underground workings, but in March 1959, the company began obtaining ore from an additional open pit operation. In April the company signed a three-year contract with Isbell Construction Co. for removal of more than 6-million cubic yards of overburden and ore. The completed pit will be about 1,500 ft long, 1,000 ft wide and 370 ft deep. Underground operations were discontinued.

Following completion of the Federal chromite stockpiling program, no chromium ore or concentrate was produced in the state in 1959.

Total mercury production in the state in 1959 was 1,300 flasks, a 42% decline from 1958. The Bretz mine of the Arentz Mining Venture and the Bonanza mine of Bonanza Oil & Mine Corp. both yielded substantially smaller quantities. Three-fifths of the total was from the Bonanza mine and most of the remainder from the Bretz open pit. Two other operations yielded small quantities.

Hanna Mining Co.'s output of nickel ore at its open pit operation near Riddle was about the same as in 1958. Approximately 800,000 short tons of ore containing 1.5% nickel was to the nearby Hanna smelting plant. Smelter production was about 10,500 tons of nickel contained in ferronickel (40-45% nickel).

Harvey Aluminum Co, which completed its first full year of operation of its aluminum reduction plant at The Dalles, resumed investigation of bauxite laterite deposits near Salem. The deposits are considered potential sources of raw material if technologic and economic developments warrant. The Harvey plant at The Dalles now smelts aluminum oxide imported from Japan.

Gold production was at its lowest level of record with little more than 400 oz recovered. There was no copper, no lead and only a very small quantity of silver produced.

Refractory metals processing facilities at plants of Wah Chang Corp. and Oregon Metallurgical Corp. at Albany, Ore. were expanded. Wah Chang installed two electron-beam melting furnaces to facilitate production of hign purity ingots. The company also started installation of rolling mill equipment which will make it the only fully integrated plant in the country capable of processing refractory metal ores through to finished products.

Oregon Metallurgical installed equipment for producing high-purity vanadium in commercial quantities and a vertical axis, vacuum arc centrifugal casting furnace for greater capacity and better quality titanium castings.

Output from the two plants consisted of ingots and castings of columbium, tantalum, molybdenum, tungsten, titanium, vanadium, hafnium and zirconium as well as various alloys. Wah Chang Corp. also produced zirconium and hafnium sponge under government contract.

Achievement of the first shaped casting of molybdenum and the first production of ductile yttrium highlighted the program of laboratory investigations at the U.S. Bureau of Mines metallurgical research center at Albany.

TENNESSEE

New Jersey Zinc Co. is reported completing the "fill-in" drilling preparatory to sinking a shaft on the Idol zinc prospect in Hawkins County. The new Idol mine will be a short distance along strike from New Jersey Zinc's Treadway mine, which was put into production Jan. 1, 1959.

Production of phosphate rock in Tennessee in 1959 is expected to be 1,854 tons, according to the USBM preliminary report. All production will be from the Central Tennessee phosphate district. This total will be only slightly less than the 1,903 tons produced in 1958.

The No. 2 blast furnace at Tennessee Products and Chemical Corp.'s Rockwood plant was re-started Dec. 28, 1959. A company spokesman said operation of the furnace, which makes pig iron, may be only temporary, depending on the market.

1959 copper production in Tennessee was 11,312 tons, which was an increase of 24% over 1958. This was 7% above the previous record established in 1930, according to USBM.

The largest copper producer is Tennessee Copper Co., located at Copperhill. Copper ore is mined from complex sulfide deposits that extend to depths of 2600 ft below the surface.

TEXAS

The most important developments in the nonmetallic mineral industry of Texas in 1959 centered in the expanding talc district of Hudspeth County about 15 miles west of Van Horn. Estimated total production during 1959 will probably be about 80,000 tons compared with an estimated 70,000 tons shipped during 1958. Southwestern Talc Corp. was the largest producer, followed by Texas Talc Co. (Dallas Ceramic Tile Co.), Southern Clay Products Co., Milwhite Co., Inc., and Royal Tile Manufacturing Co. Companies engaged in exploration and development work include Industrial Minerals, Inc., Florida Tile Industries, Inc., Continental Minerals, Inc., and Pioneer Talc Co. (Georgia Talc Co.). John S. McNabb, president of Industrial Minerals reported that their sales will be handled by Continental Ore Corp. who will attempt to develop domestic and foreign markets. At the present time, talc from the Hudspeth County district is being marketed in southwestern and southern U.S., on the east coast of the U.S., and in Mexico.

The Pioneer Talc Co. mill at Allamoore is nearly completed and will have an initial capacity of 120 tpd with facilities and space to add a second unit of 100-ton capacity.

Mining costs in the Hudspeth County district average $2.00 per ton; haulage

Colorado Columbium Deposit Held by Du Pont

DU PONT CO., Wilmington, Del., has purchased some 4,500 acres covering Iron Hill, near Powderhorn, Colo. Company geologists have identified the deposit as pyrochlore, a fluocolumbate of calcium and sodium often associated with rare-earth minerals.

Dr. R. M. Grogan, of Du Pont's development department, says in a private communication "The columbium mineral, pyrochlore, has been found in carbonatite bodies in the alkalic complex at Powderhorn, Colorado, 30 miles southwest of Gunnison. It occurs as gray to brown octahedral crystals, mostly less than 2 mm in size, distributed in narrow planar zones. It is generally accompanied by apatite and magnetite, all three being considered late primary minerals.

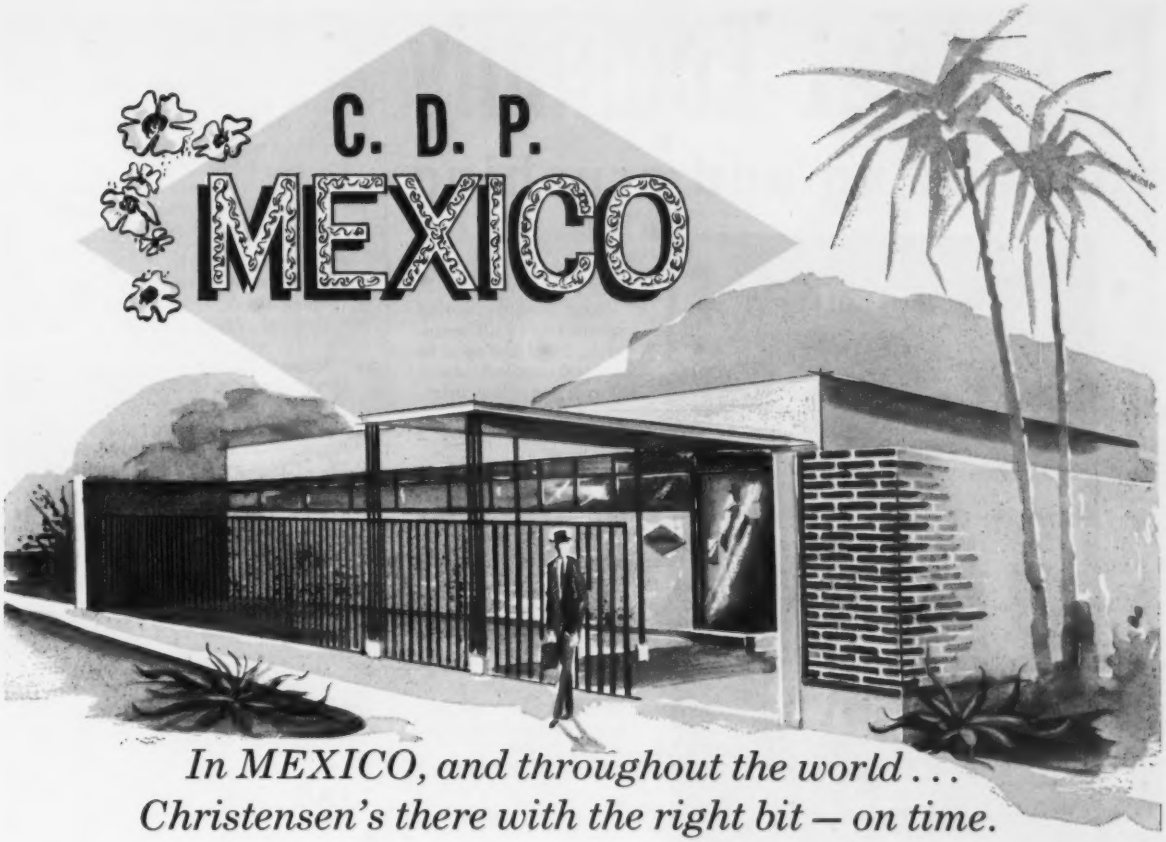
"Besides columbium, the carbonatite bodies have been found to contain small amounts of rare earths and thorium. Cerium group metals have been identified. The pyrochlore also contains traces of thorium. Radioactivity," says Dr. Grogan, "attributed to thorium has been noted in many exposures of carbonatite."

"The carbonatite bodies comprise a stock and numerous dikes of substantially identical composition and common magmatic origin," says Dr. Grogan, who continues: "The stock forms Iron Hill, 900 ft high and approximately 1.5 square miles in area. The dikes are numerous close to the stock, where they intrude pyroxenite, and become less abundant with increasing distance from it. Dikes have been observed in the fenites which form the rim of the Powderhorn complex and in the surrounding Pre-Cambrian gneisses and schists at distances of several miles from Iron Hill."

The purchase includes patented and unpatented mining claims formerly held by the Gunnison Syndicate, Humphreys Gold Corp., and other interests.

F. H. Weismiller, general manager of the company's pigments department, says "the Du Pont company has no present plans to mine the property for niobium-containing ore. Du Pont's pilot plant scale production can be sustained from outside commercial sources. The mining claims, indicating a substantial reserve, were secured in anticipation of future use."—JESSE SIMMONS, Denver

C. D. P. MEXICO



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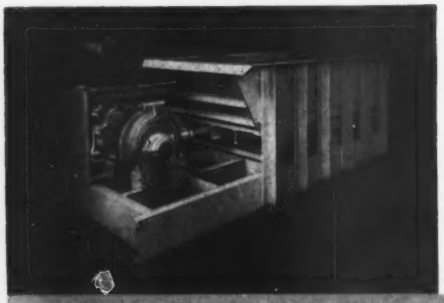

These feed controlled quantities of all materials, from fine sand to shovel-loaded rock —with very low operating costs.
Bulletin FRE-57.

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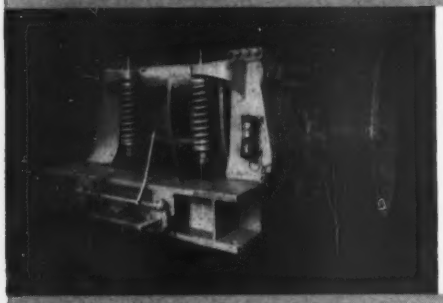
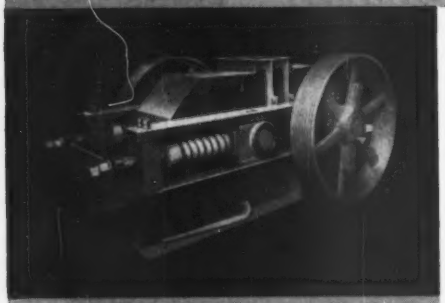


The world's most powerful single roll crushers — outstanding on heaviest duty applications and with wet and sticky feeds.
Bulletin RMTD-56.

Rockmaster Crushers



Great capacity, very low maintenance cost per ton — industry's pace setters for finer reductions of medium sized feeds.
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Heavy-Duty Double-Roll Crushers

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FEEDERS and CRUSHERS

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255 Wall Street • Hollidaysburg, Pennsylvania

Texas *(Continued)*

costs to railroad loading points range from 50c to $1.00 per ton. The selling price of crude talc loaded in cars ranges from $5.00 to $7.00 per ton.

Because of low costs and very large reserves of high-grade talc, the district will probably continue to expand as market development permits.

—PETER T. FLAWN

Susquehanna Western, Inc., subsidiary of Susquehanna Corp., proposes construction of 250-tpd uranium mill at Falls City, near the Palangana Sulphur-salt dome in Karnes County.

Grand Junction Operations Office of AEC confirmed that Susquehanna had made a proposal for milling of the low-grade uranium ore body on which AEC authorized expanded concentrating facilities relative to its action nearly three years ago to provide mills for ore bodies distant from current reduction centers.

The Karnes County mill would be Texas' only uranium concentrator. An early proposal for development of this ore body and milling of ore came from Columbia Southern Chemical Co., (which controlled the ore) with Union Carbide Corp. Subsequently, the latter firm withdrew from the jointly-held Palangana Corp. because of mining problems presented by the ore deposition.

UTAH

It was on Jan. 1, 1959, that the Kennecott Copper Corp. formally acquired the Garfield Smelter of American Smelting & Refining Co. for more than $20 million.

Capacity made this copper smelter the world's largest, although in recent years Asarco operating techniques and market factors kept the production of blister well below maximum potential.

This was another step in KCC's major move into complete integration. Its Utah Copper Division now mines, mills, smelts and refines copper in Salt Lake County.

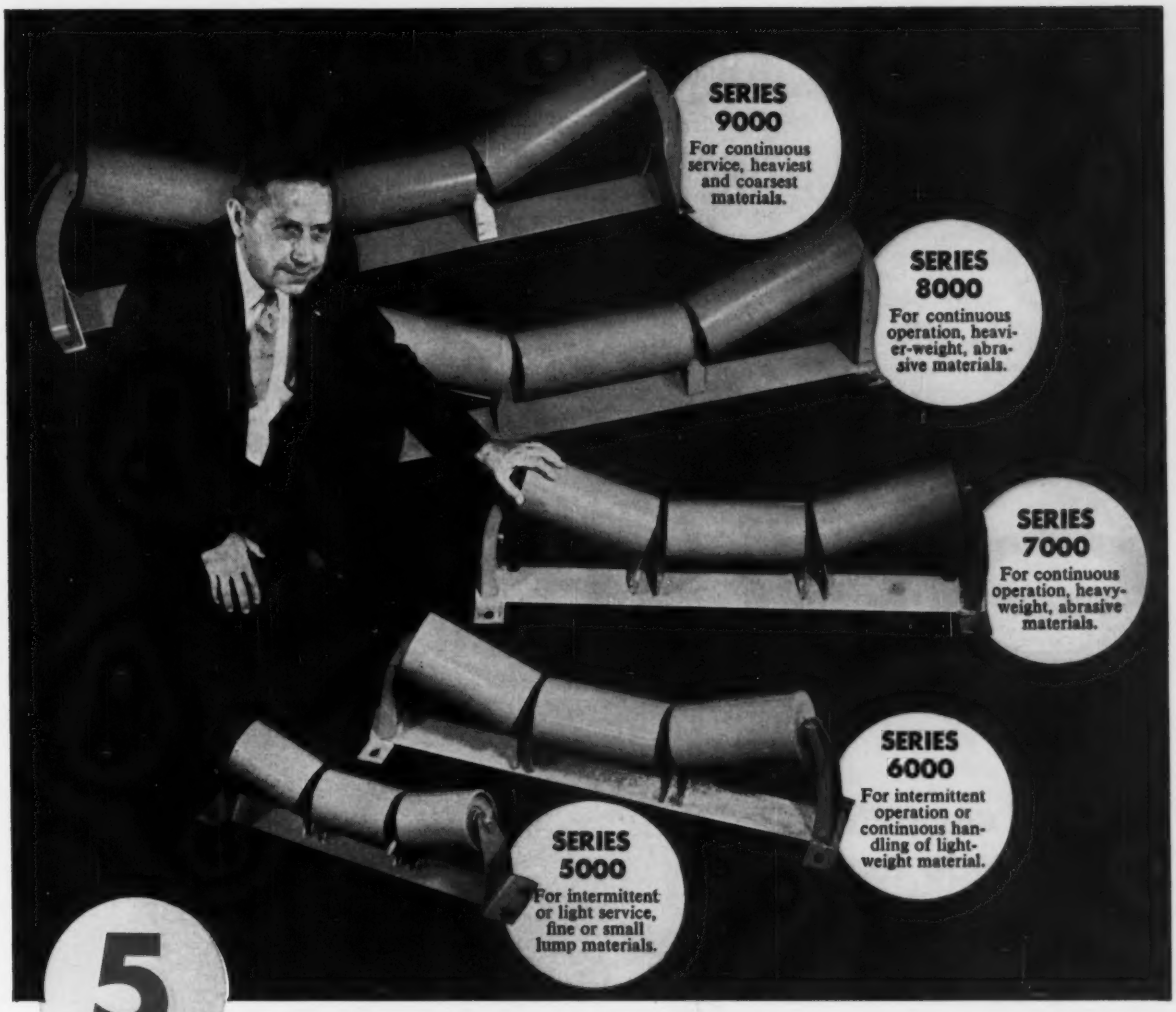
Acquisition of the smelter ended its custom status and producers of silicious ores were forced either to find new market outlet or halt production.

Utah Copper announced a $10-million renovation program at the Garfield smelter, including a move to green firing of concentrates, elimination of roasting, improvements in materials handling, change to high arch (and combustion) reverberatory furnaces, etc. New materials handling was principal reason for change custom smelter status.

The firm neared completion of steam electric plant at 16 million dollar cost which would nearly double electrical power generation available to mining operations at Bingham open pit, mills, refinery and smelter.

United States Smelting Refining & Mining Co. abandoned its Midvale, Utah, lead-zinc smelter, leaving the smelter of International Smelting & Refining Co. at Tooele the only such operation left in northern Utah.

USSR&M said that closure of the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This impressive installation at Kiruna, Sweden, demonstrates a major benefit of ASEA Multi-Rope Friction Hoists: *low initial installation cost.*

Each of these ASEA Hoists has a skipload of 22 tons and is designed for a depth of 1500 feet, maximum speed 2200 feet per minute.

At Kiruna, as in mining operations throughout the world, ASEA Multi-Rope Hoists prove less costly to operate, safer, and they reduce rope wear.

In the U.S. these advantages may be seen in the ASEA installations of National Potash Co. and The Cleveland-Cliffs Iron Company.

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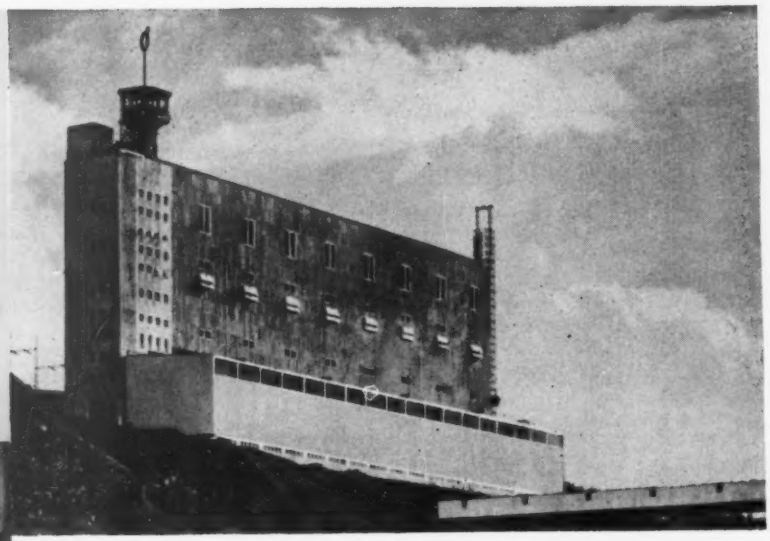
Total capacity: 4600 tons per hour



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Utah *(Continued)*

smelter was necessary because of dwindling ore supply. This reflects the crushing imports of foreign-produced lead and zinc which crippled the domestic nonferrous metals industry, firm said.

USSR&M continued its milling operation at Midvale and is also purchaser of ores. Concentrates go to Tooele's IS&R plant. Tooele shut down its mill, in turn. IS&R is wholly-owned subsidiary of Anaconda Co.

Bear Creek Mining Co., domestic exploration subsidiary of Kennecott Copper Corp., picked up major reserves of lead-silver-zinc in prospect underground and from surface at Tintic Unit in Utah's Tintic District.

The firm is continuing this work in which Chief Consolidated Mining Co. and Tintic Standard Mining Co. with other "Tintic Group" of companies hold interests.

Shattuck Denn claimed world's record in sinking of three compartment "Bardon" shaft in the Lisbon uranium district of northern San Juan County.

The firm mined out most of the orebody during 1959 where it was operating on properties owned by Kerr McGee Oil Industries, Inc.

While the record may have been bested later in 1959, in the New Mexico uranium field, Shattuck Denn crews averaged about 15 ft a day for some 30 days, employing a Cryderman mucker, special drill jumbo and safety skip.

Cerro de Pasco Corp. completed an initial prospect work on the Escalante (Holt mine) silver holdings of Chief Consolidated Mining and S.S. Arentz Venture, Salt Lake City. At year's end, firm had not announced decision on sinking of new shaft and unwatering of properties, in Garfield County.

Standard Uranium Corp., Moab, announced development of a 1.5-million ton orebody in Big Buck mine extension, Big Indian District, San Juan County. Majority of the reserves will be included in the AEC's 1962-1966 purchase program.

Standard also took over the Sunnyside lead-silver-zinc-copper-gold mines in southwestern Colorado's Silverton district.

AEC on Jan. 1, 1960 ended uranium milling at Monticello mill, which was government-owned but which National Lead Co. operated.

The mill, a pioneer in the postwar uranium industry, was used as a "sliding scale" on concentrates prices negotiations, for experimental uses involving alkaline leach with RIP processes; and as a place to experiment on dust control, disposal of radioactive tailings, etc.

AEC has never announced amount of money spent at Monticello on the concentrator. Its demise represented the end of only major industry in Monticello and was effected over objections of townspeople. The Commission will not sell the facility but proposes keeping it on stand-by basis.

Utah Construction and Mining Co. completed world's longest ore haulage

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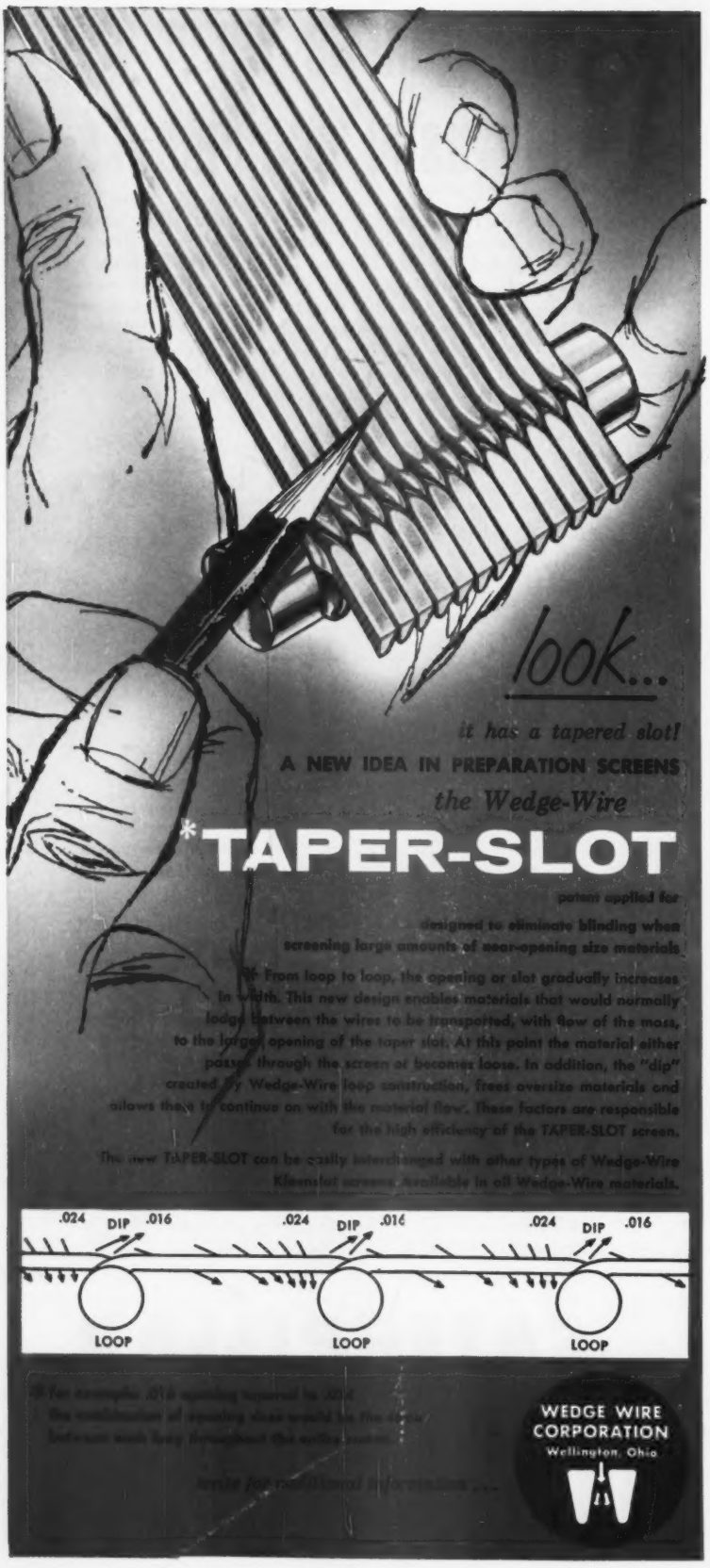
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created by Wedge-Wire loop construction, frees oversize materials and
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Utah *(Continued)*

tunnel (approximately 1,840 ft) at Bingham mine, Utah Copper Division, Kennecott Copper Corp. at cost of $8-million to Kennecott.

The new 1,590 ft level tunnel will be intersected in 1960 by bottom of the open cut mine as that property is deepened in connection with normal pit development.

WASHINGTON

Sunshine Mining Co., Spokane, estimates 1959 production of silver will be slightly greater than 1958 output. The Sunshine mine near Kellogg, Idaho, the nation's largest silver producing property, had an output of 6,111,000 oz of silver in 1958. Sunshine Mining Co.'s share of this was 3,532,000 oz. The company also expects 1959 net earnings to be slightly higher than $407,771 net in 1958.

The company points out that the price of silver is being depressed by U.S. Treasury policies which have had an adverse effect on the silver market.

The company's production picture also has been affected by a smelter strike at East Helena, Mont., operated by American Smelting and Refining Co. A large portion of the production from the Coeur d'Alene mining district of North Idaho is shipped to this smelter. Because of the strike, smelter shipments were halted from Aug. 14 to December 14 and several million dollars worth of ore was held in stockpile in the district. Sunshine ore also includes substantial quantities of copper, lead and antimony. The company said that oil production for 1959 will show a slight increase over 1958. Officials said that production from Alberta oil properties could be much greater if it were not for the present oversupply of oil on the world market.

Dawn Mining Co., a subsidiary of Newmont Mining Corp., milled about 160,000 tons of uranium ore at its Ford processing plant during 1959. This was about the same tonnage handled in 1958.

J. J. Crowhurst, Dawn manager, said that the total included 126,000 tons of ore from Dawn's Midnite mine on the Spokane Indian reservation. Another 34,000 tons of custom ore from smaller producers on the reservation and in the Mount Spokane district were handled at the mill.

The company mined and hauled 130,000 tons of ore from the Midnite mine and now has about 150,000 tons of ore in stockpile at the mill. Mining operations at the reservation property have been suspended for the winter and will resume in May. The mill had been shut down for several weeks in December because the firm had completed the six-month Atomic Energy Commission contract for milling 80,000 tons of ore. Production was resumed at the mill on Jan. 2.

So far the Midnite mine has produced about 500,000 tons of ore since the

Washington *(Continued)*

Dawn mill was started in the summer of 1957.

Biggest custom ore shipper to the Dawn mill has been Silver Buckle Mining Co., Spokane. The mill handled 24,000 tons of Silver Buckle ore during 1959. Other shipments have been from small producers in the Mount Spokane district and elsewhere.

WISCONSIN

Production of usable iron ore in Wisconsin in 1959 declined to an estimated 930,000 long tons from the 20-year low of 1,152,278 tons produced in 1958, according to preliminary figures obtained by the Wisconsin Geological and Natural History Survey in cooperation with USBM. Shipments of Wisconsin ore in 1959 were estimated at 760,000 long tons, compared with 867,071 tons during the previous year.

Improvement in the price of zinc led to the reactivation of several mines in the lead and zinc area of southwestern Wisconsin, but not in time to boost production above the 1958 output. Zinc production in 1959, in terms of recoverable metals, was estimated at 11,400 short tons, compared with 12,140 tons in 1958. Lead production last year totaled 735 short tons, as against 800 tons the previous year.

In iron ore operations, the Montreal and the Cary underground mines in Iron County on the Gogebic Range were operated by Oglebay, Norton & Co. and Pickands Mather & Co., respectively. Zontelli Brothers Division of the Pittsburgh Pacific Co. of Ironton, Minn., operated the open pit Meress and Badger mines in Florence County on the Menominee Range.

Iron ore production proceeded at a good rate for the first six months of the year, but then was brought to a halt by the steel strike. Most of Wisconsin's iron ore production was transported by rail to Ashland, for shipment by boat to lower lake ports. Water traffic at Ashland began April 24 and ended Nov. 18.

Studies were continued during 1959 on problems pertaining to the development of low grade magnetic iron ore deposits in the Butternut area of Ashland County. The Wisconsin Legislature passed a law designed to assure companies developing the deposits of a sufficient water supply.

In southwestern Wisconsin's lead and zinc area, the Mining and Smelting Division of the Eagle-Picher Co. was operating the Shullsburg Mine and the Birkett-Bastian-Andrews mines, while the American Zinc, Lead & Smelting Co. operated the Piquette Mine and the Vinegar Hill Division mines.

The future of taconite pellets and jasper ores is much brighter than that of the standard Lake Superior iron ores, John S. Wilbur, vice president for ore sales and marine of the Cleveland-Cliffs Iron Co., told the annual mining symposium of the University of Minnesota at Duluth.

Wilbur asserted that the "golden days" of the Lake Superior area as the nation's prime ore supplier ended in 1954. He pointed out that ore now is a world commodity, and foreign supplies are beating the Lake Superior district in both cost and quality.

Hauling costs make up about one-half of the cost of ore delivered at steel plants, Wilbur said. It costs $6.56 a gross ton to haul ore from a mine on the Mesabi Range to a Pittsburgh steel mill, while present ocean rates on foreign flag carriers range from $4 to $4.50 a ton for transportation from Liberia, Peru and Chile to Baltimore, largely because of the low labor costs on the foreign ships.

Wilbur said the Lake Superior district has been placed at a tremendous disadvantage by the combination of higher iron content in foreign ores and lower transportation costs for their delivery. He pointed out that the best the upper lake operators can hope for is to raise the iron content to 55%, which is hardly competitive with the 64% to 68% iron content of ores from Brazil, Chile and eastern Canada.

Wilbur said Cleveland-Cliffs would study anew the idea of conveyor belt transportation for iron ore, and would

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COPPUS BLOWERS

Wisconsin *(Continued)*

also study railroad versus truck transportation. The firm also plans to put more effort into quality control and into "tailor making" ores to the specifications of customers.

WYOMING

Continued growth of uranium mining and milling and Columbia-Geneva's stepped up exploration of iron ore deposits in the Atlantic City area highlighted Wyoming's mining activity in 1959.

Although Columbia-Geneva hasn't announced plans to develop the vast low-grade taconite deposits and build an iron ore upgrading mill southwest of Lander, it has been proceeding with acquisition of water rights, right-of-way for relocating a highway, right-of-way for an 80-mile train line from the Union Pacific mainline to the proposed mill site.

Four uranium mills were on stream at the end of 1959 and a fifth was expected to start yellow cake production early in 1960. During 1959, Western Nuclear Corp. at Jeffrey City increased capacity of its mill from 40 to 845 tpd. Lucky Mc expanded its mill capacity from 833 to 980 tpd.

Federal-Radorock-Gas Hills Partners was authorized to build a mill in the Gas Hills area and Western Knapp was given a $3-million contract to handle the construction. The mill was completed in late October. It has a 522 ton rated capacity.

Globe Mining Co., a subsidiary of Union Carbide, signed a contract with the AEC in May for a 492-ton mill in Natrona County. It is nearly completed.

Susquehanna-Western, operator of a mill at Riverton, contracted to purchase ores from Vitro Minerals in amounts that may exceed $15-million.

Lucky Mc and Utah Construction Co. directors approved a merger of the two companies subject to stockholder approval in January.

The state's mineral production during 1959 was valued at $395.3-million. Uranium ore production advanced 16% during the year, and coal production in the state was increased 11%, according to preliminary USBM estimates.

In February, Fremont Mining and Mfg. Co. began operations of mining and treating gypsum at its plant near Sinks Canyon, near Lander.

Western Nuclear Corp., the pioneer uranium mill operator in Wyoming, signed a contract with the AEC in February to expand the capacity of its mill from 440 to 845 tpd. The firm closed its mill from June 12 until Aug. 1 to modify its plant to take care of the increased allotment.

During the late winter, Western Nuclear began stripping 18-million cubic yards of overburden from its Frazier-Lamac property in the central Gas Hills. The operation was the beginning of the largest earthmoving operation in the history of Wyoming. More than 6-million yards have now been stripped and mining started in the fall.

In the Crooks Gap uranium mining district of Fremont County, Phelps Dodge began underground operation on the Green Mountain Uranium mine. Lucky Mc opened and mined the Heald property in the Gas Hills. Lisbon Uranium started sinking a 500-ft underground shaft in the south central Gas Hills. During the year, Lisbon merged with Hidden Splendor Mining.

Large and relatively shallow trona deposits have been reported discovered in the Seedskadee reclamation project near Rock Springs and plans are reported to be under consideration for the development of the trona for agricultural purposes.

The trona deposits are said to be of as high quality as those being mined by the Westvaco Co. near Green River, Wyo., and according to a newspaper report, are 500 to 600 feet closer to the surface than Westvaco's.

Western Steel Co., Inc., has announced plans to build a $145,000 prototype iron-powder producing plant.

Louis Kalman, president, said the plant will be erected near an ample supply of hydrogen and would be designed to handle two tons of ore hourly. He said after the projected plant is built his firm plans to build around it com-

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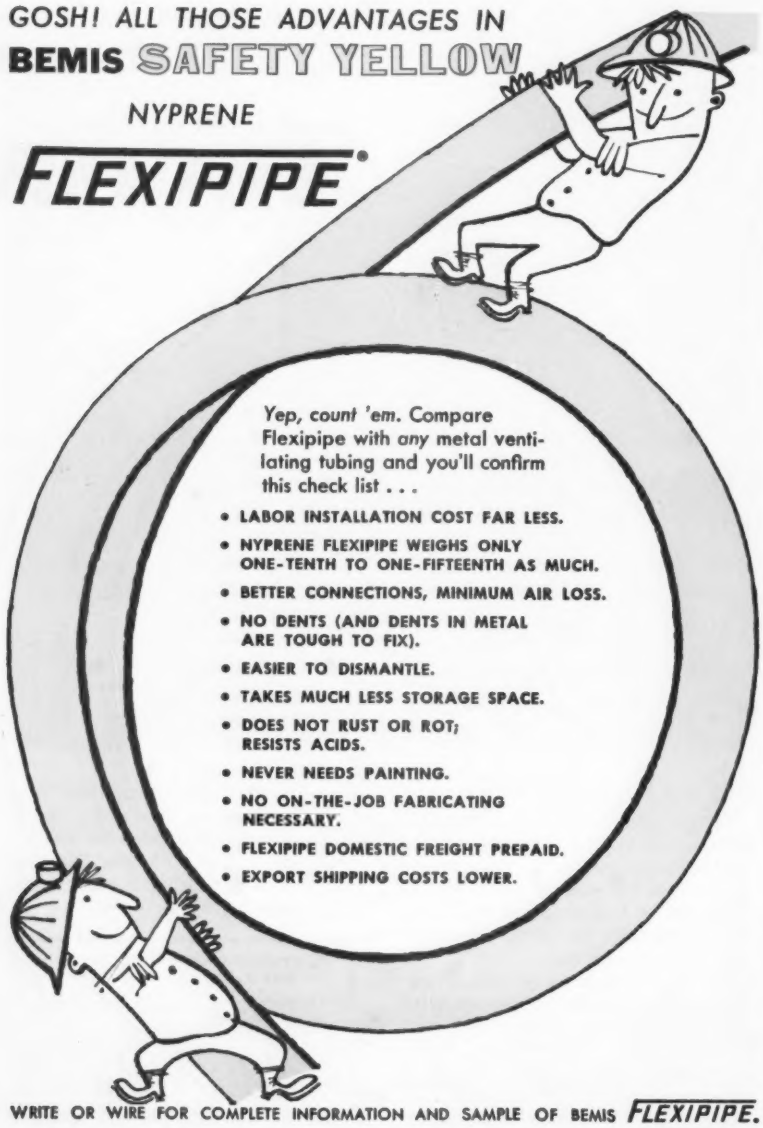

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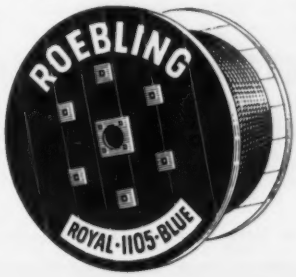

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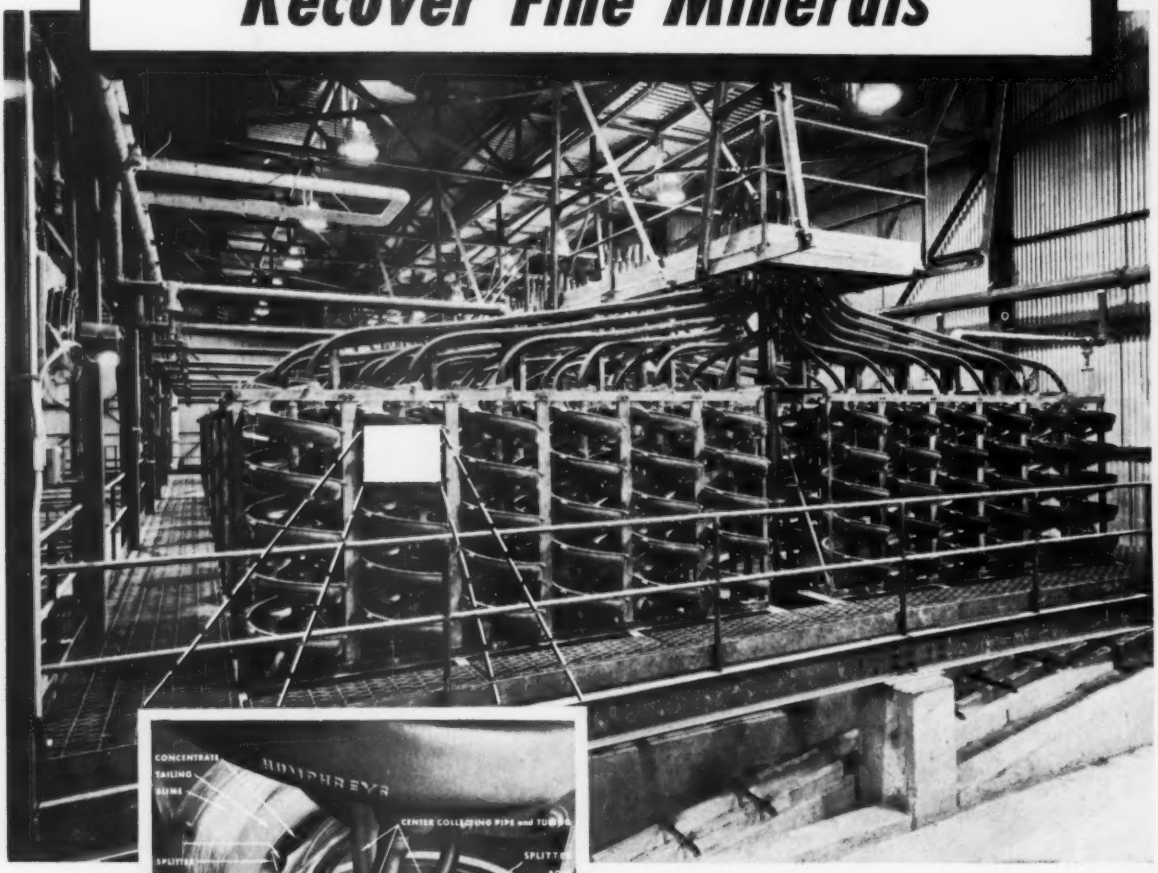

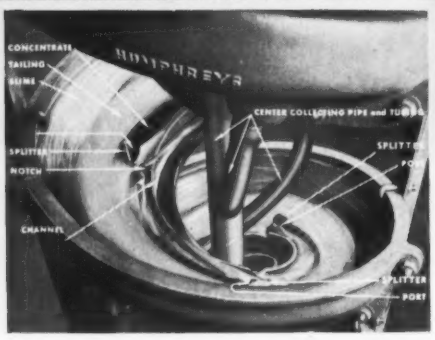

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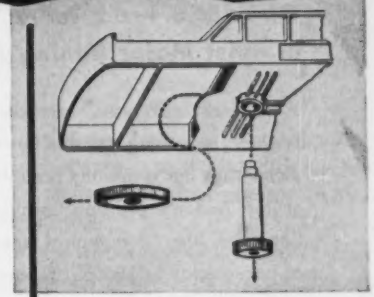

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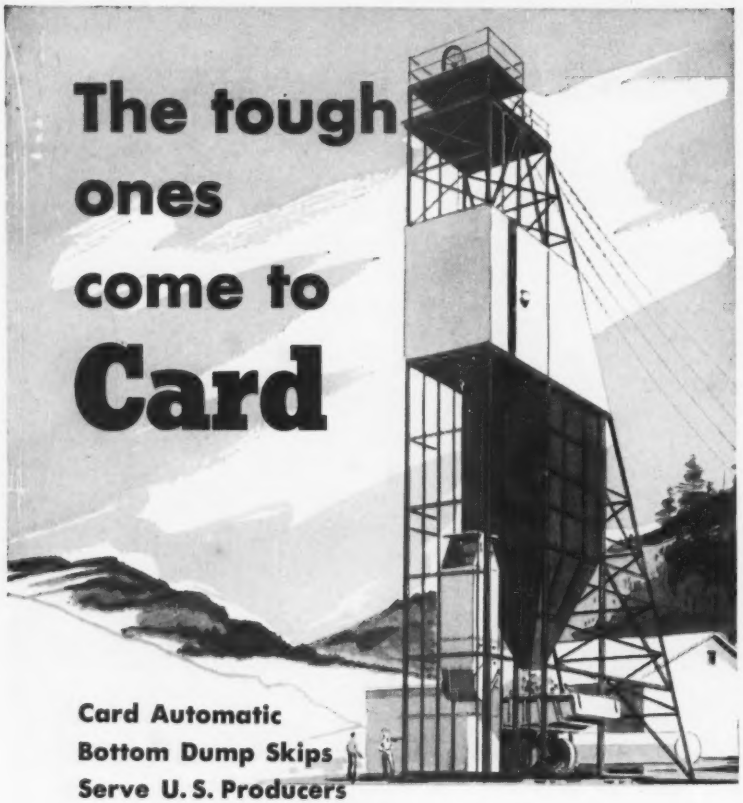

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Wyoming *(Continued)*

plete handling equipment for the ore.

Kalman said Western Steel also is planning a 250-ton capacity plant in the Cheyenne-Laramie area, using iron ore from the deposits in Iron Mountain, 35 miles northwest of Cheyenne. He said this plant would include its own hydrogen generators.

Kalman said Western Steel has been granted a universal contract for the Taylor process of producing iron powder directly from iron ore. The process was invented by Charlton A. Taylor of Pittsburgh. Previously Western Steel's contract with Taylor gave the firm rights on the process only within a 250-mile radius of Cheyenne.

The Taylor process produced iron powder directly form ore, using hydrogen as a reducing agent, eliminating both blast and open hearth furnaces. Plants for the Taylor process will be automatic and electronically controlled, Kalman said.

IN CANADA

"The Canadian mineral industry will probably remember 1959 as one of its most productive years," reports Hon. Paul Comtois, Canada's Minister of Mines and Technical Surveys in a year-end report.

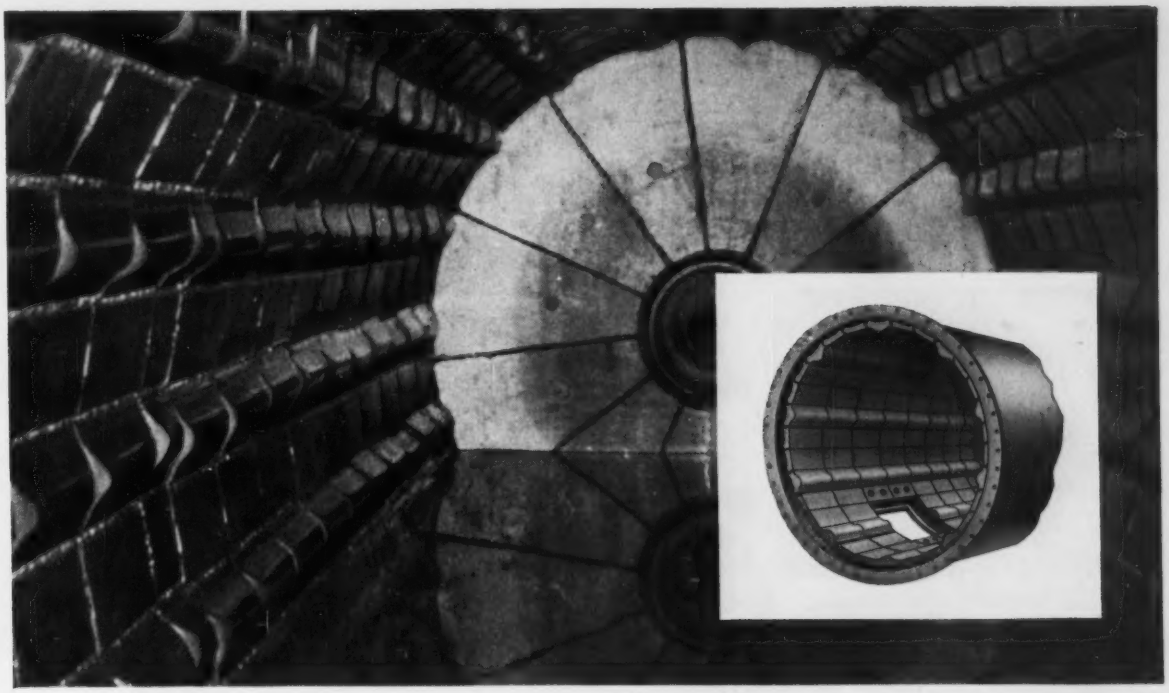
Prices for copper and zinc were the highest since the recession; exports of iron ore, asbestos and gypsum were up sharply; and marked increases were shown in the production of petroleum, natural gas, cement and salt. The final figure for the gross value of Canada's mineral output is certain to surpass the record $2,190-million set in 1957. And prospects for 1960 and beyond are reasonably good.

Particularly promising is the outlook for iron ore, whose annual production approached 19-million long tons in 1959, a rise of 5-million over 1958. And further gains are ahead. Iron ore projects under way in Quebec, Labrador, and to a lesser degree in Ontario will call for the expenditure of over $700-million in the next four years.

In 1959, the base metals picture was considerably stronger. Production of copper and lead increased slightly while that of zinc showed a modest decline.

Final figure for nickel will show a marked gain over those of 1958 (139,000 tons valued at $197-million): and the industry continues to develop its productive capacity. International Nickel Company of Canada Limited will soon bring its Thompson mine into operation, increasing annual output potential by some 37,500 tons. The cost of the Thompson project (including concentrator, electric smelter, refinery and power plant): $175-million.

Shipments of uranium in 1959 reached a record $300-million—a gain of $20-million over the previous year. Unfortunately, uranium prospects received a serious setback when the U.S. AEC dropped its options for further purchases after current contracts expire.



8 Reasons Why You Should Standardize with B&W Universal Liner Plates

Better Performance with Lower Costs—Same Casting Fits All Mill Sizes

B&W Tube Mill Liners reduce capital, time and labor costs. Consequently, they reduce the cost of the material ground. Here are eight reasons why:

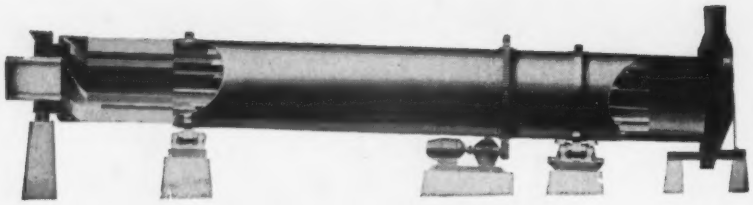
1. Lower Initial Costs—standardization eliminates chiller and pattern costs.
2. Longer Life For Liners—better quality control on a mass production casting, utilizing permanent molds, results in uniform wear. Ideal size for uniform chill and heat-treatment.
3. Longer Life for Different Applications—this is assured by selection of proper materials. Design is suitable for either chilled irons or wear steels.
4. Reduced Costs in Both Direct Labor and Outage—installation time is less because small size and weight of castings allows them to be handled easily, without cranes and with less fatigue for workers.
5. Reduces Costs in Storage Space—because small castings stack easily, little storage space is required. One design of casting interchangeable for all size mills also simplifies records.
6. Reduced Costs in Liner Inventory—standardization is possible because one design fits all diameters of mills. Standardization means quicker unloading and storage.
7. Reduced Costs on Breakage Claims and Delays for Replacements—small castings are rugged and almost impossible to break by handling. Large castings of hard, brittle irons sometimes break in shipment.
8. Reduced Costs in Determining Most Efficient Wear Patterns—you can get wear profiles consisting of all lifter ribs or all flats from the same castings, as well as a combination of both including straight or spiralled lifter pattern.

Liners are supplied in two nominal thicknesses, 1½″ and 3″ with 1½″ high lifters. Castings are 6″ wide x 12″ long. Positive seating of small castings on mill shell means less breakage of castings under operating conditions. For additional information on B&W Universal Tube Mill Liner Plates write The Babcock & Wilcox Company, Boiler Division, Barberton, Ohio.

B&W THE BABCOCK & WILCOX COMPANY

BOILER DIVISION

S-471



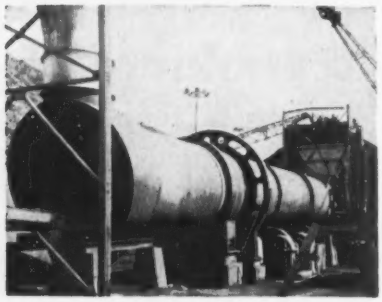
Interior of shell of "XH" Ruggles-Coles Dryer showing lifting flights and feed spirals.

from
Alumina ores
to
Zircon concentrates

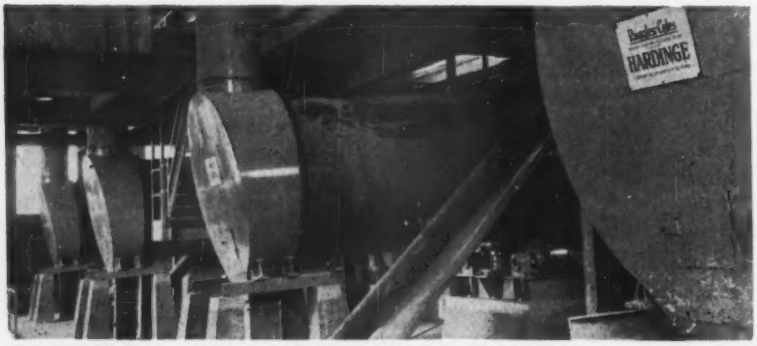
. . . in the drying of ores and concentrates. That is the story of Ruggles-Coles "XH" Dryers.

Small or large, each dryer is designed for the specific requirements of the user with the knowledge and experience gained from hundreds of installations.

Complete specifications upon request. Ruggles-Coles Dryers are described in Bulletin AH 438-1.



10′ diameter, 80′ long "XH" Ruggles-Coles Dryer drying bauxite in Jamaica.



Four 80″ diameter, 60′ long "XH" Ruggles-Coles Dryers handling asbestos ore in Canada.

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Canada *(Continued)*

Gold production in 1959 fell about 2% below the $154-million worth mined the previous year. However, to help gold mines facing high operating costs the government continued its cost aid program under The Emergency Gold Mining Assistance Act. In 1958, the amount payable was increased by 25%.

The market for industrial minerals was considerably more buoyant. By the fall of 1959 asbestos output was running about 16% ahead of the previous year; that of salt rose approximately 50% and gypsum, held down by a strike in 1958, rose 56%.

In the offing is a healthy potash mining industry. Canada's first potash producer went into operation in Saskatchewan in 1958; and while full-scale mining has been delayed by technical difficulties, future prospects for this and similar mines are extremely promising. So far, approximately 6.4-billion tons of recoverable potash have been outlined in a vast deposit extending across the province and into Alberta and Manitoba.

BRITISH COLUMBIA

One of the most important developments in the 1959 British Columbia mining picture was the increased export to Japan of iron ore, copper, nickel, coal and aluminium.

Four B.C. companies are currently exporting iron ore to Japanese steel mills. Present export contracts running about $7-million annually, will gross about $30-million for Texada Mines, Empire Development, Nimpkish Iron Mines and Hualpai Enterprises.

Empire Development Co. Ltd. has a three-year contract for 1.4-million tons of concentrate. Texada Mines Ltd. produced 300,000 for export, and Hualpai Enterprises Ltd. 15,000 tons. Nimpkish Iron Mines Ltd. is readying first shipment of 1,050,000-ton contract.

Other companies hoping for contracts are International Iron Mines with a good tonnage proved at Zeballos and Port Renfrew; Frobisher Ltd. with a large deposit at Tasco Harbor; Silver Standard Mines Ltd. with 1-million tons proved on Moresby Island.

Export of iron ore probably will triple due to Japanese research into using low grade ore.

Cowichan Copper Co. Ltd. exported 5,250 tons copper (18,500 tons of concentrate) to Japan last year and expects to do better this year. Smaller amounts have been exported by Mid-West Copper and Uranium Mines Ltd. and by Consolidated Woodgreen Mines Ltd.

Giant Nickel Mines Ltd. has a three-year contract with Sumitomo Metal Mining Ltd. for sale of all nickel concentrates from the company's mine. Shipments begin soon.

Aluminium Co. of Canada Ltd. has signed a 15-year contract to supply from its Kitimat smelter all Japan's aluminum requirements which cannot be filled in Japan. Small amounts of aluminum have been shipped to Red China by Alcan.

At Keystone Portland Cement Company's Bath, Pa., quarry, this Mack LVX takes on one of the fifty 22-ton loads it must haul each day to keep on schedule.

A 15% grade has to be tackled on the mile-long round trip from shovel to crusher. This Mack hustles up-grade with a full payload while its empty companion barrels back down to the shovel.

Our MACKS stay on the job

Round-the-clock feeding of the crusher is one phase of cement-plant operations that can't fall behind.

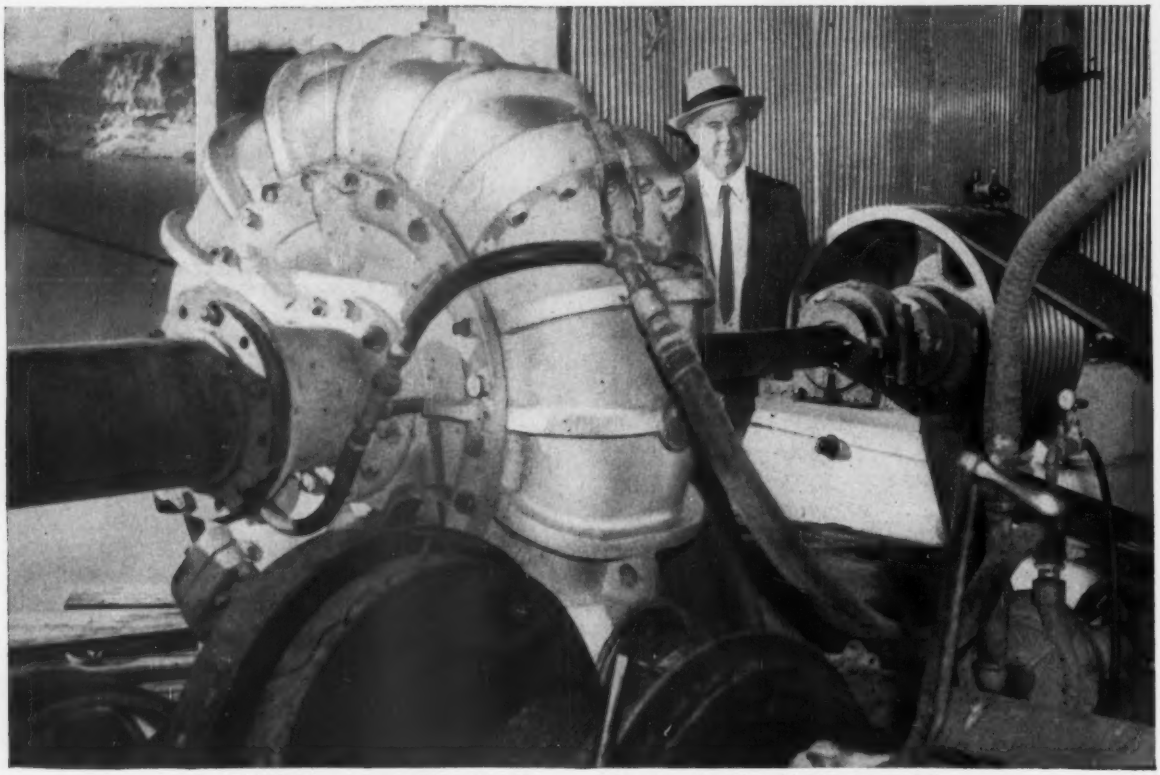
Keystone Portland Cement Co., Bath, Pa., expect each of their trucks to deliver 800 tons of rock per 7-hour shift . . . and do it at lowest cost. They get the job done with Mack 22½-ton LVX dumpers—fast, reliably and with surprising fuel economy.

Quarry Superintendent Harry Michaels says, "Our Macks give us top on-the-job performance, taking time off only for routine maintenance. They keep working day after day, month in, month out."

Why not team up *your* big shovels with Mack trucks? They'll make fast hauls between quarry and crusher. They can be depended upon to meet scheduled tonnage requirements because Macks don't bog down or break down when the going gets rough . . . handle easily the heaviest loads under the most demanding conditions.

Whatever your requirements, your Mack branch or distributor has full details on the Mack off-highway dumper that will do the job better and more economically. Mack Trucks, Inc., Plainfield, New Jersey. In Canada: Mack Trucks of Canada, Ltd., Toronto, Ont.

MACK
FIRST NAME FOR
TRUCKS



This dredge, operated by a prominent sand and gravel producer in Kansas, is equipped with a highly successful Thomas Ni-Hard pump installation.

Dredgers report Ni-Hard alloy pumps outwear others 4 to 6 times

From state after state come reports of the extraordinary service life of Thomas Ni-Hard pumps, made by Thomas Foundries, Inc., Birmingham, Alabama.

A West Virginia sand and gravel producer, for example, reports, "Since 1953, we have used only two Ni-Hard shell liners . . ."

A New Jersey company formerly replaced parts every 2 to 3 weeks . . . now says, "Today, we get approximately a year's service . . . a lifesaver."

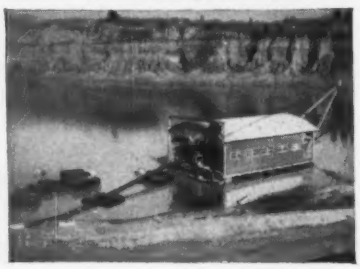
From Nebraska: – ". . . after almost two years of pumping has required no repairs, major or minor."

From Arkansas: – ". . . by far the most efficient and economical pump we have ever used, our 40-year records prove."

From these reports, it's easy to see that *longer pump life means lower operating costs!*

And a large part of the credit for the outstanding durability of Thomas Pumps goes to Ni-Hard* nickel-chromium cast iron.

This alloy is the most abrasion resistant of all commonly used cast materials, out-lasting many 4 to 6 times . . . regularly outwearing manganese steel in pump service.



What's more, Ni-Hard alloy has demonstrated remarkable impact resistance . . . being widely used for drop balls, crusher linings, and for many other severe applications. In impellers, casings, linings, and other parts for pumps, Ni-Hard alloy has virtually eliminated cracks or impact erosion caused by gravel and rocks.

If severe wear is running up your operating costs – it will pay you to find out what Ni-Hard alloy can do. Inco's booklet, "Engineering Properties and Applications of Ni-Hard" gives you essential details, and Inco's "Ni-Hard Buyers' Guide" lists authorized producers throughout the country. Write us for your free copy.

*Registered trademark

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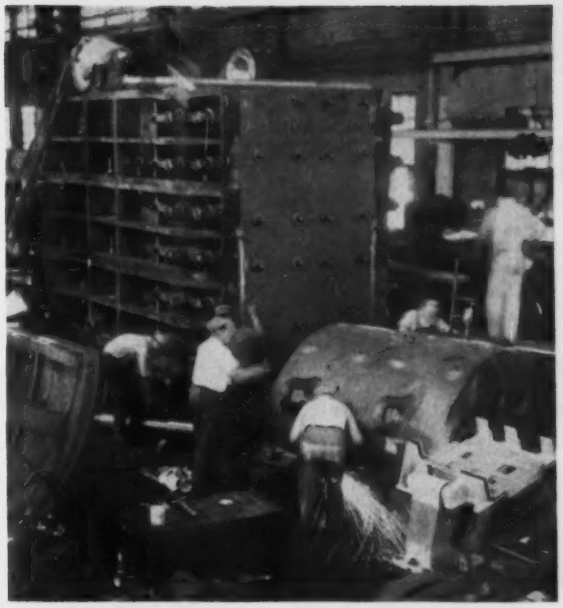
INCO NICKEL

NICKEL MAKES ALLOYS PERFORM BETTER LONGER

Rugged, rigid—right for the job!

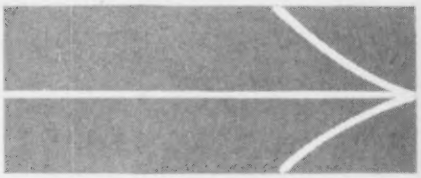
BIRDSBORO · BUCHANAN
deep frame jaw crushers

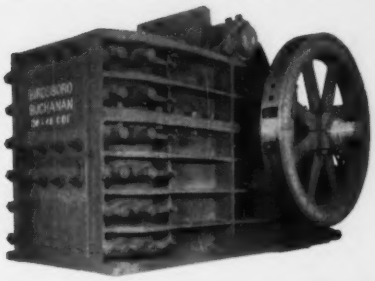


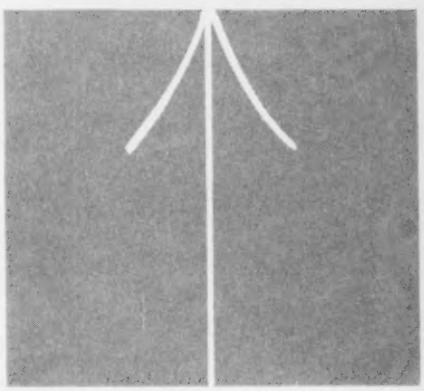
The BIRDSBORO-Buchanan Deep Frame design for Primary Jaw Crushers has long ago proven itself in production of profits. For example, the very first Buchanan crusher ever built *actually outlasted the plant it was used in*. All crushers are high quality electric steel castings thoroughly annealed. Precision machining of all joints to standard templates assures accurate fit. Extra depth through the front head provides great strength and rigidity. Your BIRDSBORO representative can show you many other construction benefits that pay off for you . . . both short range and long. *Sales Department, Engineering Department and Mfg. Plant:* Birdsboro, Pa., *District Office:* Pittsburgh, Pa.

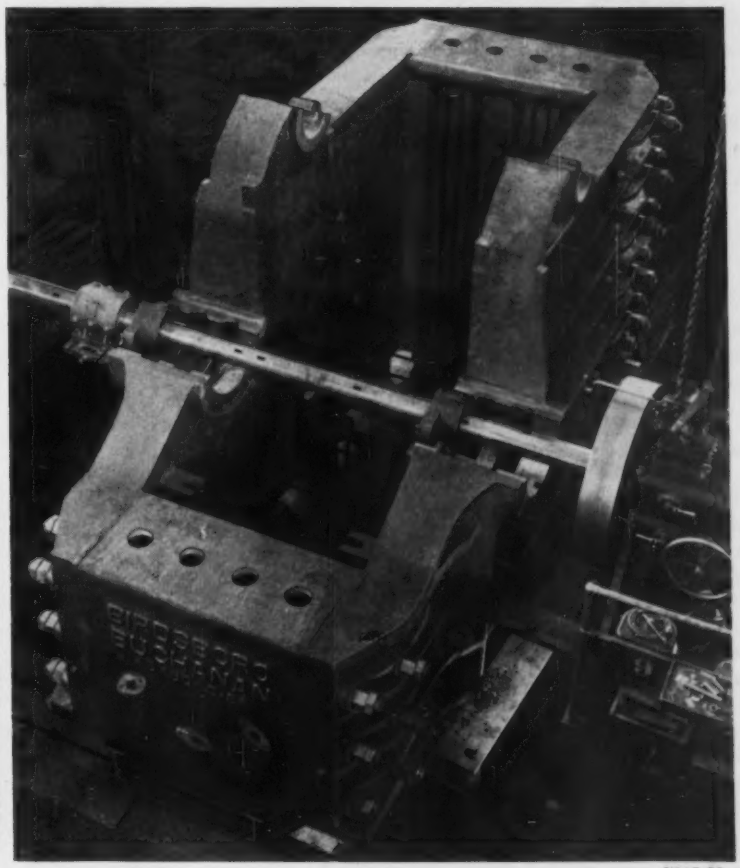
Canadian Representative & Manufacturer: John Inglis Co., Ltd., Toronto, Canada.

World-Wide Agent Representation. Contact home office for nearest representative.









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BIRDSBORO
CORPORATION

STEEL MILL MACHINERY • HYDRAULIC PRESSES • CRUSHING MACHINERY • SPECIAL MACHINERY • STEEL CASTINGS • Weldments "CAST-WELD" Design • ROLLS: Steel, Alloy Iron, Alloy Steel

Lima announces new 5-yd. shovel, 140-ton special crane

TYPE 1800

- Standard 5-yd. shovel with 35-ft. boom, 26-ft., 10-in. dipper handle; 7 or 8-yd. dipper for coal handling
- Converts to 112-ton crane
- Variable capacity dragline

TYPE 1800SC

- 140-ton special crane with 21-ft. wide truck base for stability with big lifts
- Converts to variable capacity dragline

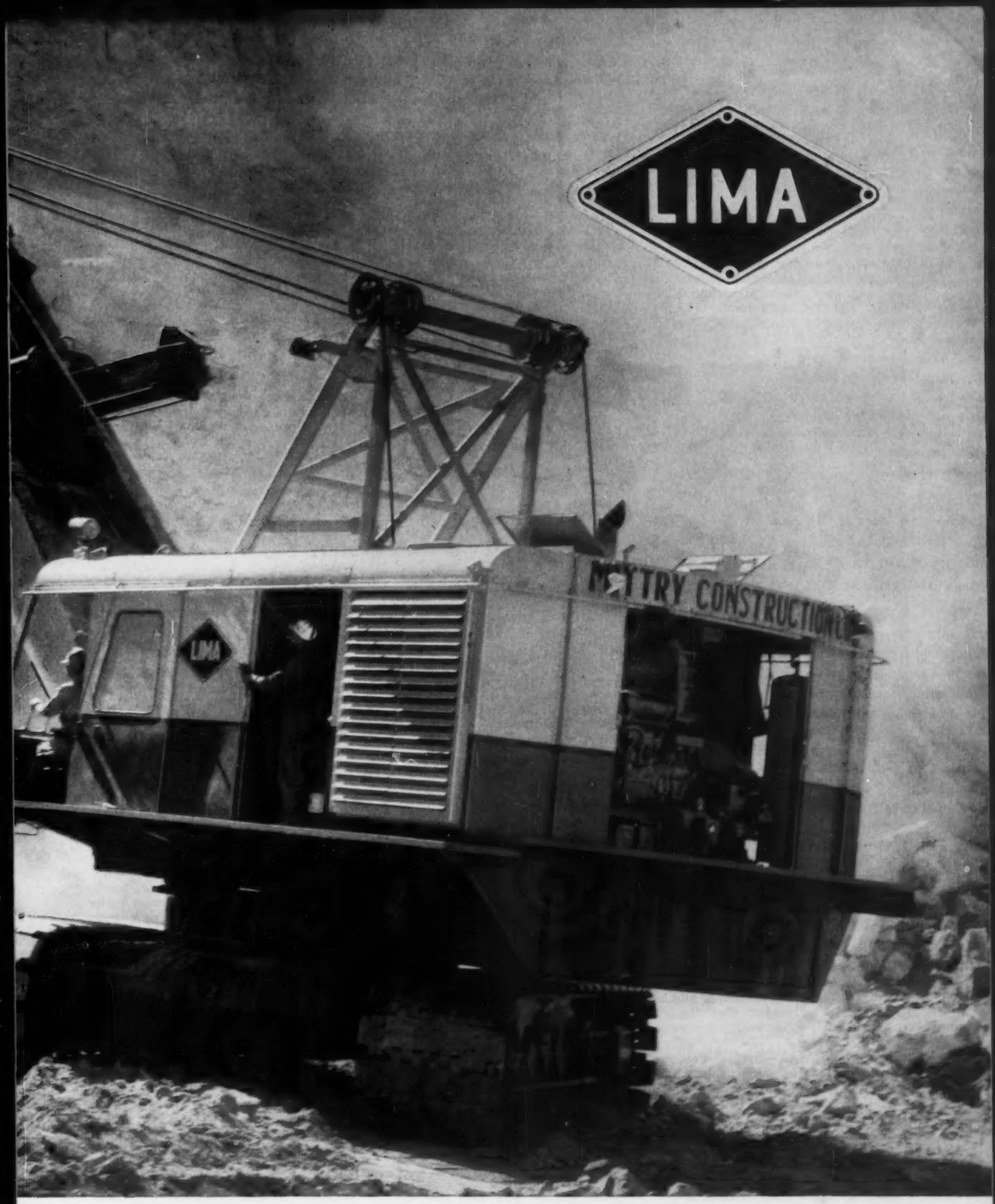
These new Limas are designed to permit knock down for job to job transportation. Side assemblies come off as a unit—including belts, crawler chains and sprockets. Counterweights are removable. Backhitch-telescopic-type gantry folds down to 17-ft., 5-in. overhead clearance.

LOW MAINTENANCE REQUIREMENTS—You get more for your money when you buy a LIMA. They last longer, perform better, and require less maintenance. Lima offers you all of these important features in a single machine—

- **Air control**
- **Torque converter drive**
- **Anti-friction bearings at all important bearing points**
- **Large diameter clutches and brakes**
- **Two-shoe-type swing-propel clutches**
- **Combination rope-chain crowd**
- **Single-inside-type dipper handle, 15″ square**
- **Extra long crane booms and special jibs available**
- **Convertible to crane or dragline**
- **9′-10¼″ dia. roller path**
- **Six cone rollers, six hook rollers**
- **Standard or long, wide crawlers**
- **Diesel or electric power**
- **Knock down for highway transportation**
- **Independent two-drum boom hoist**
- **Independent propel**
- **Auxiliary third drum**
- **Power load lowering**

FACTS AND FIGURES on the new 1800 and 1800SC are yours for the asking. See your nearby Lima distributor today or write to Baldwin-Lima-Hamilton Corporation, Construction Equipment Division, Lima, Ohio.

Lima Type 1800 5-yd. shovel—one of five Limas owned by Mittry Construction, Los Angeles. Shown excavating at Abiquiu earth fill dam project, Shama River, N. Mex.



LIMA Construction Equipment Division, Lima, Ohio

BALDWIN · LIMA · HAMILTON

600

Shovels • Cranes • Draglines • Pullshovels • Roadpackers • Crushing, Screening and Washing Equipment

B. C. *(Continued)*

Estimates of British Columbia's 1959 mineral production, released by Mines Minister W. K. Kiernan show on increase of $7.5-million over 1958.

The 1959 estimates (with 1958 final figures in brackets) are; total value, $154.4-million ($146,875,081); gold $6.2-million ($6,762,020); silver $7.3-million ($6,086,299); copper $3.8-million ($2,964,529); lead $34.8-million ($34,627,075); zinc $43.8-million ($43,-234,839); iron plus nickel $6.7-million ($5,189,949); by-product metals, including antimony, bismuth, cadmium, indium, and tin, $4.4-million ($3,501,-637); industrial minerals, including asbestos, sulphur, gypsum, and others $14-million ($11,763,473); structural materials, including clay products, cement, lime and limestone, rock, building stone, sand and gravel $22.2-million ($19,999,576); coal, $5.2-million ($5,-937,860); petroleum and natural gas, $6-million ($4,923,615).

Although government mineral taxation legislation has discouraged some international mining groups, considerable exploration is reported. At least 40 companies are actively searching for metals. Financial backing comes from Britain, U.S. and eastern Canada. Leading the field are American Smelting and Refining Co.; Bethlehem Copper Corp. Ltd.; Bralorne Pioneer Mines Ltd.; British Yukon Exploration Co. Ltd.; Bunker Hill Co.; Canex Aerial Exploration; Cerro De Pasco Corp.; Conwest Exploration Co. Ltd.; Ecstall Mining Co. Ltd.; Frobisher Ltd.; Granby Mining Co. Ltd.; Highland-Bell Ltd.; Moneta Porcupine Mines Ltd.; McIntire Porcupine Mines Ltd.; New Consolidated Canadian Exploration Ltd.; New Jersey Zinc Exploration Co. (Canada) Ltd.; Newmont Mining Corp. of Canada Ltd.; Nicolet Asbestos Mines Ltd.; Nimpkish Iron Mines Ltd.; Noranda Exploration Co. Ltd.; Northwest Ventures Ltd.; Northwestern Exploration Ltd.; Rio Tinto Canadian Exploration Ltd.; Southwest Potash Corp.; Silver Standard Mines Ltd.; Utah Co. of the Americas and Western Canada Steel Ltd.

Lundberg Explorations of Toronto, working for Wenner-Gren B.C. Delevopment Co. has staked more than 700 claims outside the Rocky Mountain Trench area in northern B.C. and staking is continuing. Claims are the result of aerial surveys of 128,000 square miles followed by ground surveys revealing indications of copper, iron, lead and zinc mineralization. Hans Lundberg, head of the firm, said the mineral exploration is separate from the 40,000-square mile area set aside by the B.C. government in its agreement with Wenner-Gren and stressed that the firm was in competition with everyone else and had no special privileges.

Department of Mines reports number of claims staked up to Aug. 31 totalled 9,200, down slightly from the 9,700 staked in the same period last year, and a third of the 1957 total of 26,170.

Reorganization took place in eight B.C. mines in 1959. Bralorne Mines Ltd. and Pioneer Gold Mines Ltd. merged to become Bralorne Pioneer Mines Ltd. Object of the merger was to increase efficiency and lower costs by avoiding duplication in the workings of the two adjoining mines.

Britannia Mining and Smelting Co. Ltd. was liquidated and reopened January 1959 as Howe Sound Co., Britannia Division. It now is engaged solely in mining and milling operations.

Granby Consolidated Mining, Smelting and Power Co. Ltd. operating under a restrictive corporate structure, reorganized and became Granby Mining Co. Ltd.

Privateer Mine Ltd. reorganized its share structure and took the new name of New Privateer Mine Ltd.

Woodgreen Copper Mines which went into bankruptcy in fall of 1958 was reorganized and is now operating under the name of Consolidated Woodgreen Mines Ltd.

Farwest Tungsten Copper Mines Ltd. has changed its name to Farwest Mining Ltd. and Surf Inlet Consolidated Mines Ltd. formed a new company to be known as Western Surf Inlet Mines Ltd. (N.P.L.)

A new company, Giant Nickel Mines Ltd. was formed to return to production the Western Nickel property formerly worked by Western Nickel Ltd. which went into liquidation. This was done also to provide a new field of operation for Giant Mascot Mines Ltd.,

HIGH-GRADE mica is mined by blasting ore and removal by a front end loader.

Maine Mica Mine Increases Production

A small, but extremely high-grade mica mine, 75 miles north of Portland, Me., is expanding its output, which is sold to the Government stockpile.

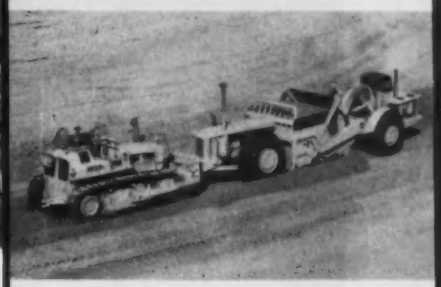
Brothers Roger and Chester Wheeler, until recently lumbermen, use a 100-hp Eimco front end loader to break the mixture of rock and mica out of the 400-ft cleft in the side of Wheeler Mountain and carry it up out of the mine pit bottom to the dump-spreading ground where it can be worked over for the precious scraps with which the earth seems to abound.

Most of the mica removed thus far has come from the initial hole which measures about 400 x 75 ft in depth by 50 ft wide. However, a 165-ft tunnel has been driven into the mountain already and at least three other lodes have been exposed in the 150-acre tract plus an additional 100 acres leased on adjacent land.

About 45 ladies of the town of Bethyl have been trained in the trimming and rifting the mica preparatory to its sale to the Government purchasing office set right up in Bethyl. While the normal number of women workers is about 8 to 10 a day, having more workers trained in the processing insures workers for peak load times.

MINE OPERATORS Roger (left) and Chester Wheeler look over some of the hand-picked mica from their property.

At a coal stripping operation in Pennsylvania, this TC-12 removes overburden at a rate of 400 to 500 yds. per hour. It is equipped with 16' blade...works two 8 hr. shifts a day.



Euclid Twin-Power teams — TC-12 Crawlers and TS-24 Scrapers — move over a million yds. a month at this Wyoming open pit uranium operation.

Model C-6 crawler back-filling overburden in the pit . . . full-power shift, good visibility and fast response make this "Euc" a high production machine for mine and quarry work.

Work-ability of "EUC" Crawlers Steps Up Production on Tough Stripping Jobs

Euclid's modern crawlers—the 211 net h.p. Model C-6 and the Twin-Power Model TC-12 with 425 total net h.p.—have set new standards of tractor production in mine and quarry work. With performance proved Torqmatic Drive, both of these crawlers have excellent maneuverability and fast response that cuts work cycle time. They're engineered for easy service accessibility that results in less downtime and lost production.

Have your dealer give you all the facts on these "Euc" tractors...he'll show you the features that pay off in better production on every stripping job, whether it's heavy dozing or ripping work, push loading big scrapers, or moving coal, ore and other materials.

EUCLID Division of General Motors
Cleveland 17, Ohio

Plants at Cleveland and Hudson, Ohio, and Lanarkshire, Scotland.

GM GENERAL MOTORS EUCLID

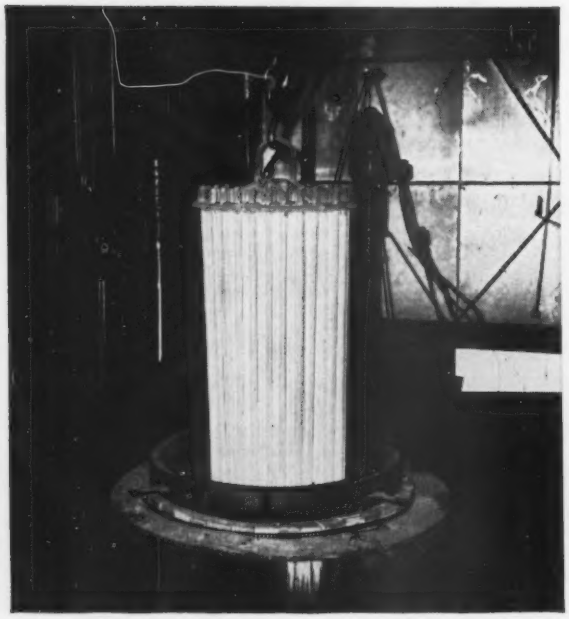
EUCLID EQUIPMENT

FOR MOVING EARTH, ROCK, COAL AND ORE

HARD-HITTING DRILLS

THE SIZE, THE POWER AND

5 ½" hammer diameter—Here's deep hole drilling power that packs plenty of punch. Gardner-Denver DH143 fills the rock drill gap between wagon drill and rotary rig.



Tough and long-lasting—Gardner-Denver drill steel. Emergence from heat-treat furnace shows carburizing process that results in abrasive-resistant exterior and tough inner core.

First choice in crawler drills—The versatile swing-boom "Air Trac"®. Now available in a variety of models including stiff- and swing-boom units with complete hydraulic components.

FOR ANY ROCK BLAST

THE SPEED YOU NEED

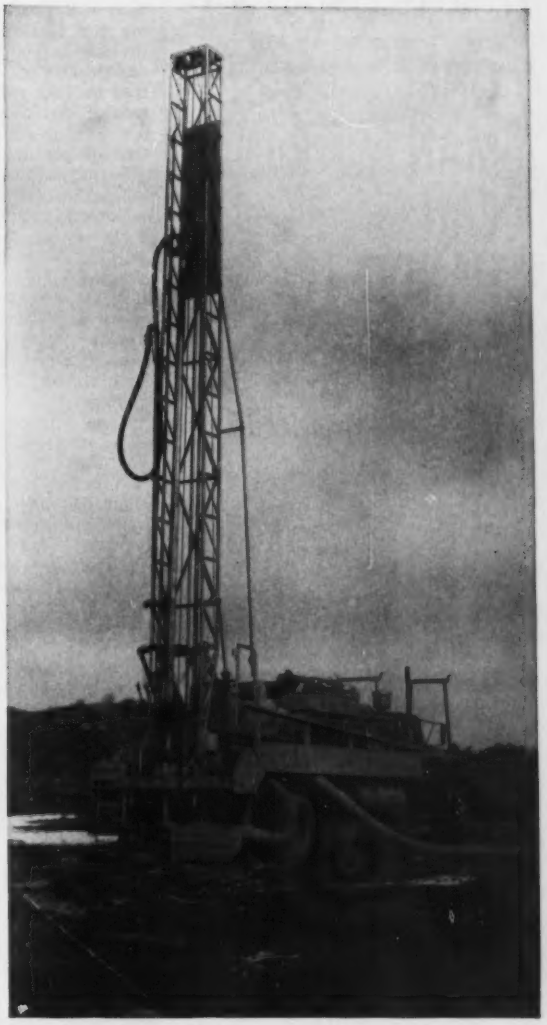
Select your rock drills from the most complete line of drifters in the field . . . GARDNER-DENVER

Gardner-Denver offers the most complete range of drifter drills known, thus assuring the right drill for your application, regardless of what it may be.

Talk to a Gardner-Denver blast hole specialist before you buy new rock drills. His experience can help you select the best blast hole plan and the right equipment for the job from Gardner-Denver's complete line of drills, rigs, steel and accessories.

MIDNIGHT MISSION

When unexpected developments demand immediate attention (additional equipment, essential parts, special service), a Gardner-Denver man is ready to go—any time, anywhere. And at Gardner-Denver, there's no substitute for men—our 100-year philosophy of growth.



In-the-hole power for rotary rigs—New Gardner-Denver "Mole-Dril"* rides with the bit through rock . . . delivers more striking power than any other drill of its size.

EQUIPMENT TODAY FOR THE CHALLENGE OF TOMORROW

GARDNER-DENVER

Gardner-Denver Company, Quincy, Illinois
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In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Avenue, Toronto 16, Ontario

*Trade-Mark

Withstands wear & tear!

Moderately priced!

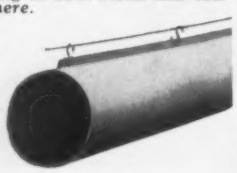
A B C

NEOLON®

FLEXIBLE VENTILATION TUBING

One man can install it or take it down —weighs only a fraction of rigid metal pipe. As tough as a tire, because NEOLON is made of neoprene coated nylon fabric —almost impossible to tear or puncture. Can't be dented like metal pipe and costs much less. Easier to store. Most popular ventilation tubing in both metal and coal mines. *everywhere.*

Standard lengths — diameters 8" to 36". Choice of Demountable or Sewed-In Couplings and two types of suspension.



This new Wire-Reinforced NEOLON Tubing for pulling out foul air. Use with any exhaust fan or suction fan.

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A B C AMERICAN BRATTICE CLOTH CORP.

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B. C. *(Continued)*

almost dormant since 1956. Pacific Nickel Mines Ltd. will hold a 49% interest in the new company and Giant Mascot will hold 51% which it bought from Newmont Mining Corp. and Sherritt-Gordon Mines Ltd.

Several mills were put into production or planned in 1959. Western Canada's first iron and steel mill is being built at Kimberley by Consolidated Mining and Smelting Co. Initial phase of the $20-million project called for the construction of sintering and furnace feed facilities with a capacity of 100,000 tons of iron oxide a year, and an electric furnace with a capacity of 36,500 tons of pig iron a year, and eventual construction of steel ingot and steel rolling facilities.

Consolidated Woodgreen Mines mill started in July with a capacity of 1,000 tpd and Granby Mining Co. Ltd. has installed a light metals foundry at Allenby to supply western Canada with magnesium and aluminium castings. Granby also modernized its steel foundry which supplies grinding balls for ore mills, mill liners and allied steel castings.

B.C. Lightweight Aggregate Ltd. completed its $800,000 shale crushing plant on Saturna Island. First of its kind in the Pacific Northwest, it will supply lightweight aggregate to British Columbia, Washington and Oregon.

A major tungsten deposit in the Mackenzie Mountains in Northwest Territories is being developed by Canada Tungsten Mining Corp. (a new group including Highland-Bell Ltd. of Vancouver; Leitch Gold Mines; Area Mines; Dome Mines; Ventures Ltd. Lake Expanse Mines; J. J. Rankin; Karl Springer and several prospectors). The discovery is described as the highest grade tungsten deposit in North America.

Drilling has indicated 1,166,352 tons of ore averaging 2.18% tungsten trioxide enough to keep a mill operating for more than 10 years at 300 tpd ore. Open-pit production may begin by the end of 1961.

Platinum was discovered in diamond drill cores by Mid-West Copper and Uranium Mines Ltd. A special run of an 8-in section of core showed 0.85% platinum and 0.45 oz gold per ton. It was recovered about 30 ft below an intersection of 2 ft assaying 1.78 oz gold per ton with 3.53% copper.

NEWFOUNDLAND

Asbestos fibre shipments from the test plant of Advocate Mines at Baie Verte are being made to plants in the U.S. and Europe as part of the over-all assessment program being carried out at the property. Surface drilling, underground exploration and development programs designed to determine grade and tonnage more exactly are complete.

Mill construction at the Little Bay copper property of Atlantic Coast Copper is expected to get under way this spring in preparation for production at a rate of 750 to 800 tpd by the end of the year. Underground work on five levels to depth of 1,000 ft to make ready for stoping operations, is continuing. Independent studies last May showed total ore in sight, and indicated, of 2.6-million tons averaging 2.11% copper. Operations are under the direction of O'Brien Gold Mines, which holds about 43% of the issued shares of Atlantic.

ONTARIO

Algom Uranium Mines is encountering higher grade ore in deep development work at both the Quirke and Nordic mines in the Elliot Lake area. At the Quirke three new levels, the 7th, 8th, and 9th, are being opened up bringing mine working down to depth of 1220 ft. Estimated tonnage on these three levels is around 3.5-million tons grading better than 2.5 lb uranium oxide per ton. At the Nordic, shaft deepening to 1320 ft to open four new levels was completed in November and crosscutting is currently in progress on the 7th and 8th levels. Indicated grade is better than mine average of 2.45 lb oxide per ton.

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Applications are diverse. A copper concentrator uses them on full tonnage, rejecting an essentially minus 15 micron slime from the primary cylinder, with the secondary overflow being the flotation feed, and the small tonnage of underflow reground and recycled.

While most of the 20 Models and the vast majority of Krebs Cyclones in operation are single-stage, 70 plants have installed the two-stage cyclones to obtain the most efficient upgrading.

This is only one of many Krebs Cyclone design developments in the past 10 years. Recent work indicates even wider applications and economic advantages with the Krebs integral two-stage cyclones.

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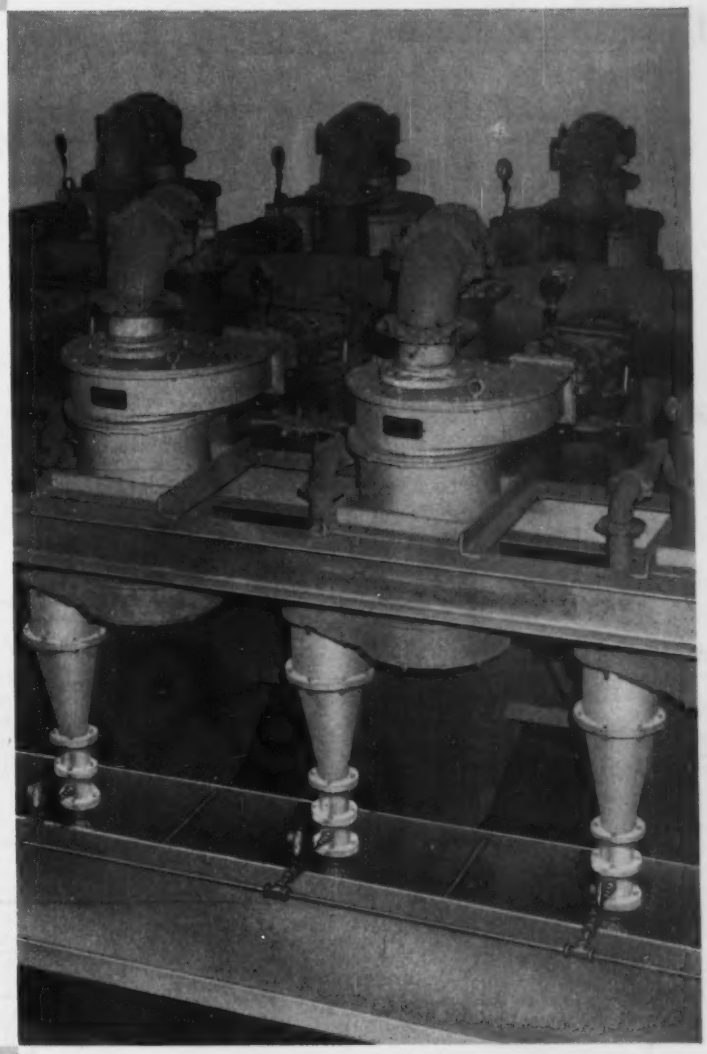
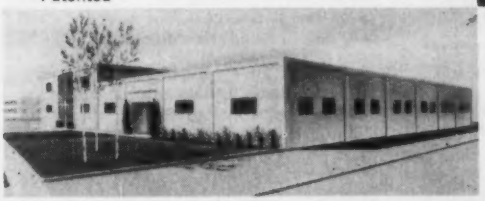


*Patented



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Ontario *(Continued)*

Pronto Uranium Mines, uranium producer in the Elliot Lake area, is starting a program designed to prepare its nearby Pater copper property for production. At present a new road is being constructed between the two properties. It is planned later this year to unwater the Pater shaft and carry out deep diamond drilling from the bottom or 950-ft level. Shaft deepening is planned for a later date. Previous work was estimated to have indicated just over 1-million tons grading about 2.1% copper to depth of about 1200 ft.

Nickel Mining and Smelting is continuing a deep diamond drill test, initiated late last year, at its nickel property at Gordon Lake, north of Kenora. At the same time rehabilitation and extension of underground workings are in progress to test and open various ore zones located in previous work.

Faraday Uranium Mines is pushing production at the maximum possible rate at its uranium property in the Bancroft area. The company is geared to turn out some 425,000 lb of uranium oxide in the period Dec. 1, 1959, to Apr. 30, 1960, the date on which its tax-free period ends. Thereafter it is planned to reduce production covering 1,923,000 lb oxide, in the remaining months of the contract period ending July 21, 1962. Additional production after that date would be possible through purchase of contracts from other producers. Production in 1959 was a record $9,434,047, an increase of $650,000 over 1958.

Renabie Mines, gold producer in the Missinaibi area, has been obtaining good results in drilling the new 'N' orebody. The orebody is indicated to be wide open below the 1550-ft level and above the 1250-ft level.

Consolidated Denison Mines, largest uranium producer in the Elliot Lake area, turned out an impressive $49- to $50-million worth of uranium oxide in 1959. This compares with output of $42.3-million in the previous year. With just over $97-million needed to fill the balance of its contract with Eldorado Mining and Refining in the next 39 months, the company is scouting around for purchase of additional contracts. Offers have been made for some contracts believed to be available, but nothing official has been announced yet. The company's ore position is more than adequate to meet present contract requirements.

Canadian Charleson, Ltd. shipped 179,411 tons from its property near Atikokan in 1959. About 21,000 tons of this came from ore stockpiled in 1958. The ore is high in iron and low in moisture.

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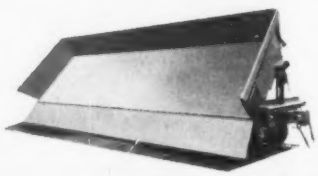

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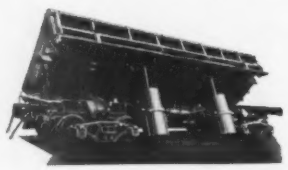

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QUEBEC

Quebec Lithium Corp. expects to be turning out lithium carbonate from its new lithium plant by the end of February. The plant, located at the mine property in the Val d'Or-Barraute area, is the first of its kind in Canada. Initially it is planned to produce upwards of six tons of lithium carbonate per day. Early in January it was announced that the company's contract dispute with Lithium Corporation of America had been settled. Quebec Lithium was awarded damage payments totalling $1.9-million. Payment is spread out over a four year period with a total of $1-million to be paid by next Sept. 1.

St. Lawrence River Mines has initiated a diamond drilling program to test the 'A' zone for open pit operations at its columbium property in the Oka area. The company has also started operation of a pilot mill in Montreal. The mill has a capacity of some 4 tpd and is being used for metallurgical testing as well as for research on a full-sized mill. Previous drilling on the Oka property indicated a tonnage of 22,500,000 tons averaging 0.3% columbium pentoxide, which it is estimated can provide by selective mining 9,300,000 tons of 0.5%, or 2,047,500 tons of 0.7%. A second zone 'D' is estimated to contain 13,500,000 tons of material grading 0.3%.

Copper Rand Chibougamau Mines is hitting production stride at its new 1,500-ton capacity plant in the Chibougamau area. This is the fifth producer in the camp. Initial tune-up, utilizing ore from underground, gave a grade of better than 2.5% copper with recovery

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Quebec *(Continued)*

above 90% for production of concentrate averaging more than 27%. Initially mill feed is being drawn from underground but this is being augmented with ore from three separate surface dumps. Mill feed will also be taken from the adjoining Chibougamau Jaculet property at a rate of 200 tpd, and if development is favorable, from the nearby Portage Island property.

Work at the Portage Island (Chibougamau) Mines' property is in progress on three levels, at the 400, 550 and 700-ft horizons. These drives were to be well into the anticipated ore areas by the end of February. The copper-bearing zones are located under Lake Chibougamau, but no water problems have been encountered and adequate progress is being made in the drives.

Bouzan Mines has concluded an agreement with Copper Rand Chibougamau Mines for an underground test of its copper property in the Chibougamau area. The Bouzan ground adjoins south of Copper Rand. The program initially will involve approximately 1100 ft of drilling and 12,750 ft of diamond drilling from extensions of the Copper Rand 1,000-ft and 1300-ft levels. Previous drilling in this area by Bouzan encountered encouraging copper values, but results were too erratic and difficult to correlate.

MANITOBA

Premier Duff Roblin announced an agreement has been reached by the provincial government and the Hudson's Bay Mining and Smelting Co., Ltd., for the company to begin working commercial quantities of zinc and copper in the Snow Lake area 70 miles east of Flin Flon, site of major operations of the company. The company will also provide services for a new subdivision at Snow Lake community and the province will administer the town. Snow Lake has been inactive as a mining area since the Britannia Mining Co. suspended gold operations there six years ago.

SASKATCHEWAN

International Minerals & Chemicals Corp. is seeking the advice of additional consultants on procedures for lining the shaft walls to block off formation water, at its Esterhazy potash development. Excavation of the shaft has been at a standstill since July 1958, when the 1200-foot level was reached. Water-impregnated Blairmore formation sands caused repeated floodings, at that level. A chemical grouting experiment failed to control the water. A freezing station was then constructed at 1,200 feet, with inconclusive results, said resident manager Merton I. Signer. Mr. Signer recently inspected mine shafts in France and Germany where lining procedures had solved similar problems.

IN LATIN AMERICA

ARGENTINA

With few exceptions, all mining activity carried on with about the same rhythm as it did in 1958. The outlook for 1960 is somewhat brighter and for 1961, considerably brighter—principally because of a modern zinc smelter which will go into operation during that year.

Lead and zinc continued to be Argentina's most important metallic minerals as far as mining activity is concerned. It is still too early to pinpoint the 1959 output of lead concentrates, but it was estimated at 40,000 metric tons, as it has been since 1956. Output of zinc concentrates was over 70,000 metric tons and was possibly even as high as 75,000 metric tons. The previous year's zinc concentrates output was 68,500 metric tons, but the increased output last year in no way benefits the local market. The zinc output has mounted simply because

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RECORD TUNNEL DRIVING AT MAMMOTH POOL POWER PROJECT PROVES IT

Project personnel include: Boyd C. Paulson, project manager (above); Steve E. Wilmoth, general supt.; Paddy O'Dowd, Jack Robertson, and O. "Heavy" Holman, tunnel supts., Utah Const. Co.; Harold Barber and Neville S. Long, engineers, Southern California Edison Co.

Solid blue granite doesn't slow Brunner & Lay carbide Rok-Bits. In driving the 8-mi. Mammoth Pool power tunnel, the Utah Construction Company's crews set a hard-rock record of drilling 390 ft. of the 20-ft. dia. horseshoe tunnel in six 24-hr. days. Brunner & Lay Rok-Bits were used 100%.

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Argentina *(Continued)*

production is scheduled on the basis of lead ore requirements and the mixed lead-zinc ores worked in 1959 were especially high in zinc content. Hence, while zinc concentrates pile up around the mines, Argentina continues to import refined zinc in quantity.

In recent years the production of tungsten concentrate has fluctuated around 1,000 metric tons, but it dropped to 930 metric tons in 1958 and almost certainly fell another 200 metric tons last year. The estimated tungsten concentrate output of 700 metric tons in 1959 has two causes:

The expiration in mid-1958 of a five-year purchase contract between the U.S. GSA and the Argentine government agency, Cocomine, which has a monopoly on tungsten ore purchases; and the unfortuante circumstance that the cost of domestic production has pushed the price of Argentine tungsten up above the world market price. Even increased Cocomine support prices have not been able to satisfy all producers.

The output of beryllium concentrates was also down—from 910 metric tons in 1958 to an estimated 700 metric tons in 1959—and for a similar reason: the production costs went up and the returns did not increase in proportion. Many of the marginal mines are having to close down.

The year 1959 saw a slight increase in the output of iron ore concentrates—to an estimated 70,000 metric tons from 65,000 metric tons in 1958—because of the pig-iron blast furnace, with a yearly capacity of 75,000 tons, which was put into operation in October at the works of Fabricaciones Militares (Military Factory Administration) at Zapla, Jujuy Province. Another pig-iron blast furnace of the same capacity will go into operation at Zapala during the first half of 1960.

Hence the iron ore picture is brightening considerably. Previously Fabricaciones Militares, with its two antiquated pg-iron furnaces which turned out a yearly production of only 30,000 metric tons, sharply curtailed the demand for ore. Another reason for optimism in this respect is the possibility of the exploitation of the iron ore deposits in Patagonia's Sierra Grande. There have been some bids in reply to the Government's tender for the exploitation of the area, but so far no award has been announced.

The 1959 output of manganese ore probably was somewhat above the 33,000 metric tons produced in 1958 (no figures, not even estimates, are yet available for last year's manganese), and the demand in 1960 will increase still more with the completion—by the Sociedad Mixta Siderugica Argentina (Somisa)—of a large integrated steel mill at San Nicolas in Buenos Aires province.

In 1959 there was very little movement in uranium, the last of Argentina's metallic minerals which are mined. Output probably did not exceed 6,000 metric tons of ore last year.

BOLIVIA

Tin exports for 1958 were 18,003 metric tons, while exports for 1959 are estimated at 24,200 tons. (From the total Bolivian exports, 95% are mineral, representing 65% of tin exports).

Lead. Despite the close of Pulacayo mine and world market unfavorable conditions, 1959 exports were 21,000 tons, against 22,815 in 1958.

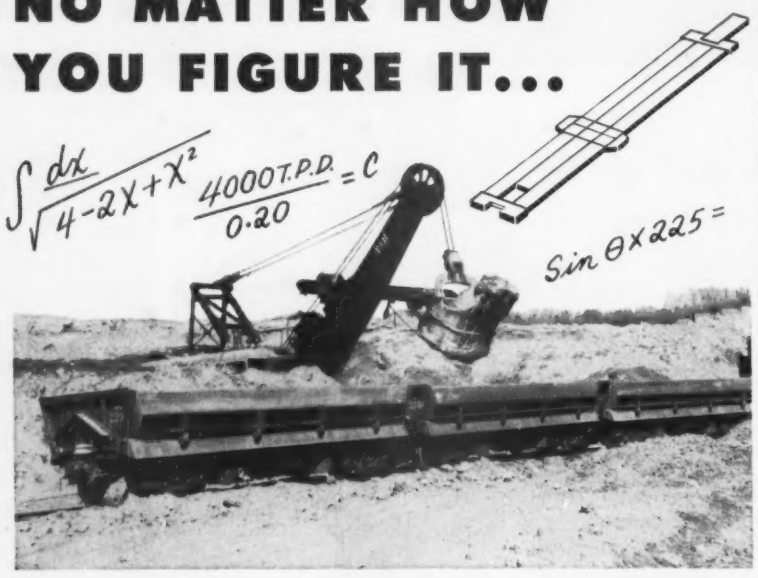
Silver. Because the close of Pulacayo operations and the restrictions of imports to American market, exports of this mineral have substantially decreased.

Bismuth. There was a great increase in exports, from 41 tons in 1957, to 111 tons in 1958 and 200 in 1959.

Wolfram. Since the expiration of the contract with the U.S. GSA production has decreased. However, it is expected to increase in 1960 due to recent price improvement.

Zinc. There was a drop in the production due to the fall in prices. Total exports for 1958 were 14,222 tons; it is estimated that exports were about 3,000 tons for 1959 (both by nationalized mining and private mining). MCB is at

NO MATTER HOW YOU FIGURE IT...



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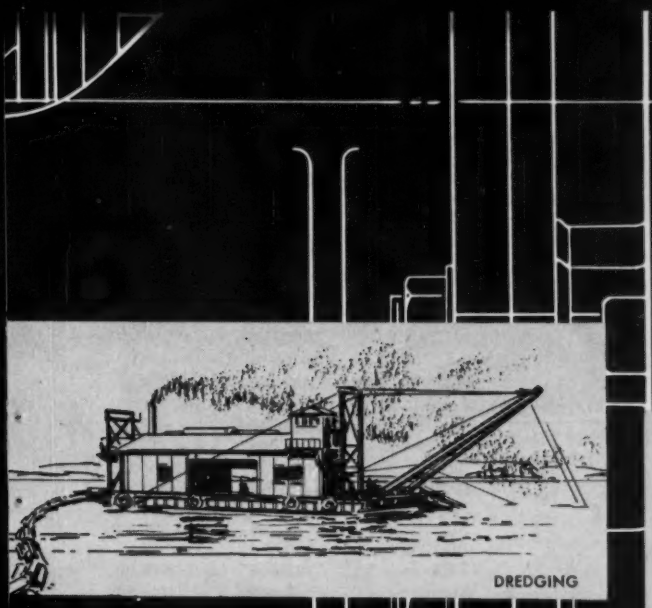

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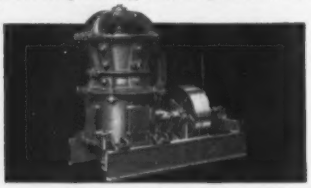
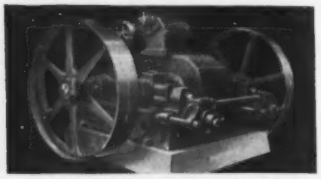
Jaw Crushers — Produce coarse (5 in. largest model) to fine (¼ in. smallest model). Eight models range from 2 x 6 in. jaw opening (lab model) to 12 x 26 in. Capacities to 30 tph. All except two smallest sizes operate on double cam principle — crush double per energy unit. *Request Bulletin No. 062.*



Rotary Fine Crusher — Reduce soft to medium hard 3 to 8 in. material down to ¼ to 1¼ in. sizes. Capacities up to 30 tph. Smallest model has 6 x 18 in. hopper opening; largest, 10 x 30 in. Non-clogging operation. Single handwheel regulates size. *Request Bulletin No. 063.*



Crushing Rolls — Reduce soft to hard 2 in. and smaller materials to from 12 to 20 mesh with minimum fines. Eight sizes, with rolls from 8 x 5 in. to 38 x 20 in.; rates to 87 tph. Three types — Balanced Rolls; Plain Balanced Rolls; Laboratory Rolls — all may be adjusted in operation. *Request Bulletin No. 065.*

Hammer Mills — Reduce to 20 mesh. Swing-Sledge Mills crush or shred medium hard material up to 70 tph. Hinged-Hammer Pulverizers crush or shred softer material at rates up to 30 tph. Four Swing-Sledge Mills with feed openings from 6 x 5 in. to 20 x 30½ in. Four Hinged-Hammer Pulverizers with feed openings from 12 x 12 in. to 12½ x 24 in. *Request Bulletin No. 084.*

**Reports Manager W. Carleton Merrill concerning Sturtevant Swing-Sledge Mill at James F. Morse Co., Boston.*

STURTEVANT
MILL COMPANY
101 Clayton St., Boston 22, Mass.

Bolivia *(Continued)*

present considering the large-scale exploitation of Matilde zinc mine, and there were semi-official proposals to that effect on the part of certain foreign companies.

Generally speaking, MCB's financial situation is very serious because of market conditions, costs of operations and the heavy burden coming from obligations of previous years.

Nationalized Mine Production

(Estimated, 1959)

	Metric tons
Tin	15,900
Lead	6,550
Antimony	7.086
Tungsten	440
Silver	112
Gold	0.117
Copper	1,570
Zinc	2,250
Bismuth	182

Nationalized Mine Exports

(Estimated, 1959)

	Metric tons
Tin	17,868.283
Lead	6,479.694
Tungsten	51.349
Silver	119.629
Gold	1.551
Copper	1,624.341
Zinc	2,849.961
Bismuth	202.160

Improvement is expected in working conditions through new equipment and machinery to be purchased with the recent £2-million loan given by Williams Harvey.

During January, MCB faced a problem in connection with the termination of "cheap" prices policy of certain food items. Mining workers are threatening a general strike; MCB is offering compensation of salaries.

During the period from December 1956 to December 1959 about 8,633 workers have been fired.

With regard to private mining, government is helping with the erection of small smelter plants. The existing ones are going well; -Peró is increasing production; Metabol is making efforts in that connection, and Hormet of La Paz recently announced that within the next few months it will start operating a plant for the treatment of low-grade tin minerals.

Total Exports

(Estimated)

	January/ October Metric tons	January/ September Value— U. S. $
Tin	19,339.433	39,828,570.08
Lead	17,405.071	3,462,008.51
Antimony	4,408.340	1,069,677.65
Tungsten	1,195.709	1,026,415.13
Silver	110.817	2,930,883.61
Gold	1.095	367,398.10
Copper	2,277.422	1,227,690.02
Zinc	2,663.160	594,506.71
Bismuth	159.684	412,045.41
Asbestos	103.000	13,000.00
Mercury	0.400	2,144.52
Total		$50,934,339.74

Exports by Group

	January/ September, 1959 Value— U. S. $
Mining Corp. of Bolivia	35,506,664.77
Medium mining	3,437,746.12
Medium mining (Mining Bank)	1,041,150.16
Small mining (Mining Bank)	9,099,317.68
Oruro smelter (Pero)	1,381,154.87
Hormet smelter	53,523.11
Metabol smelter	148,187.42
Central Bank of Bolivia	266,595.61
Total	$50,934,339.74

Illustrating the export decrease during the recent years, Mining Corp. of Bolivia gives the following figures:

Year	Value—U. S. $
1952	135,986,571
1953	109,496,596
1954	98,664,584
1955	97,761,404
1956	99,968,856
1957	88,423,783
1958	55,730,352

SLURRYS FLOW *thru* RED JACKET VALVES

PROVEN PERFORMANCE in the Mining Industry on milk of lime; metallic ores, pelletizing applications, uranium processing lines, copper tailings, and other problem materials.

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Mine Locomotives 3 to 12 Tons

Engineered expressly for

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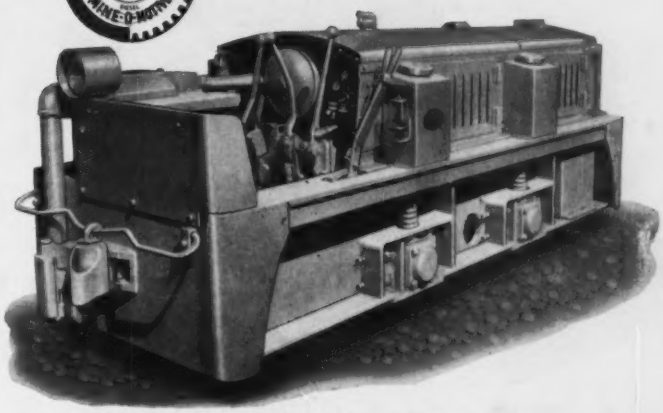
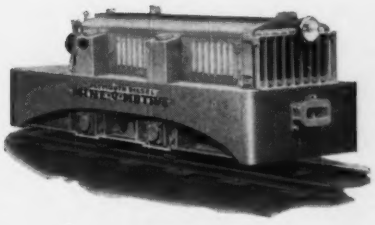
in Today's modern mining operations

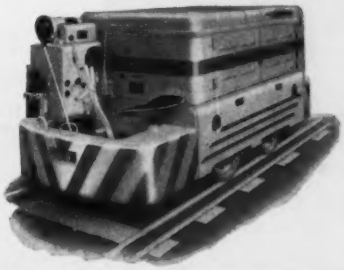
You will find these rugged locomotives performing the toughest hauling jobs in mines and tunnels everywhere. Stamina, stability—ECONOMY in performance, SAFETY in operation—and extra years of trouble-free operation—are ENGINEERED in the design and construction of the Mine-O-Motive series. Controls are convenient, simple, safe. Visibility is excellent. And the Diesel-powered models shown have the famous Torqomotive* Drive for easy starting and smooth operation. They supplement Plymouth gasoline, Diesel and Diesel-electric models which have served all industry since 1914—and with lowest ton-mile costs in the field.



U. S. Bureau of Mines approved exhaust conditioning equipment.

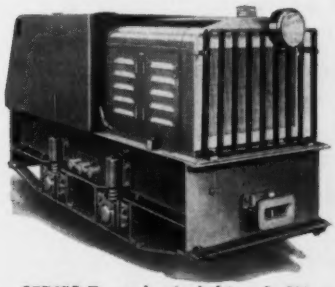


MINE-O-MOTIVE SERIES Model FMD-00 5 or 6 Tons, Torqomotive* Drive—short wheel base, low center of gravity.



MINE-O-MOTIVE SERIES Model FMD-22 5, 6, 7, 8 or 10 Tons, Torqomotive* Drive (this model approved under Permissible Schedule #22, U. S. Bureau of Mines, for operation in gaseous mines).

MINE-O-MOTIVE SERIES Model DMD-00, 8 to 12 Tons, with Torqomotive* Drive — low, compact, one-piece welded frame.



SERIES T, mechanical drive, 3, 3½ or 4 Tons. Torqomotive* Drive in 3½ or 4 Tons.

*TORQOMOTIVE DRIVE: Plymouth Transmission coupled to Hydraulic Torque-Converter.

FREE ANALYSIS Send us a brief outline of your hauling operations. An engineering analysis will reach you promptly with latest data on the type and size Mine-O-Motive for the best results in the work you want done.

PLYMOUTH LOCOMOTIVE WORKS

Division of the Fate-Root-Heath Company

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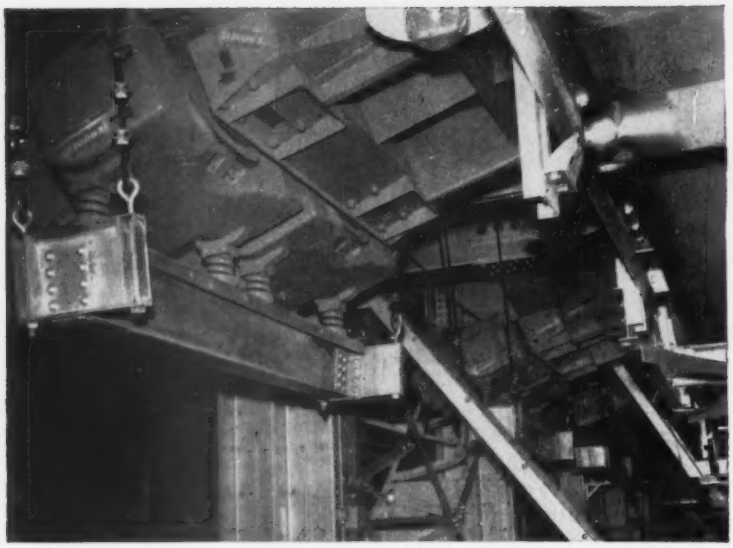
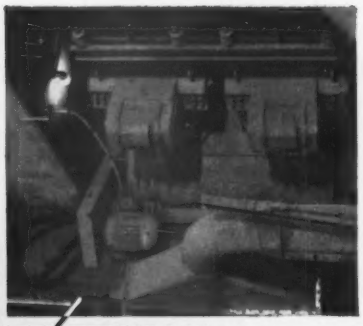
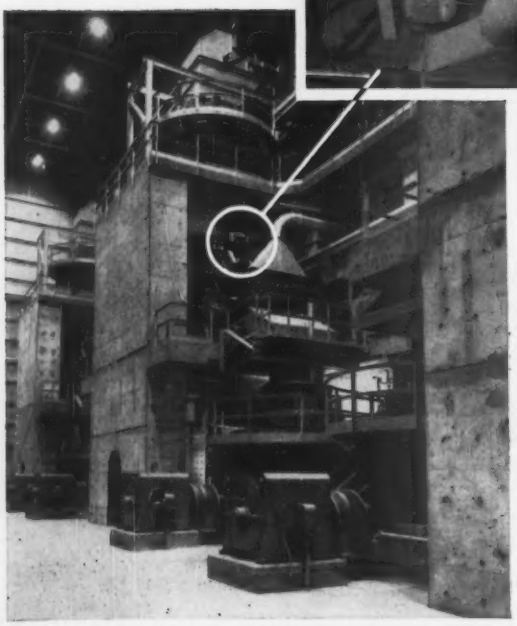


Jeffrey feeders move coarse ore from surge bin to cone crushers. Balanced vibration assures quiet operation, definite control, low operating and maintenance costs.

Battery of Jeffrey feeders serves hungry taconite crushers

Jeffrey feeders at bottom of cone crusher move ore to next crushing stage.





Into this stand of cone crushers passes a steady flow of coarse taconite ore, fed by a battery of 36 Jeffrey vibrating feeders. Fine ore is fed by Jeffrey vibrating feeders to screens ahead of the short head crushers.

Dependability of Jeffrey equipment helps move materials at a 24 hour-a-day, year 'round pace. *Efficiency* of Jeffrey equipment helps make the whole operation economical. Use Jeffrey experience on your materials handling problems. The Jeffrey Manufacturing Company, 974 North Fourth Street, Columbus 16, Ohio.

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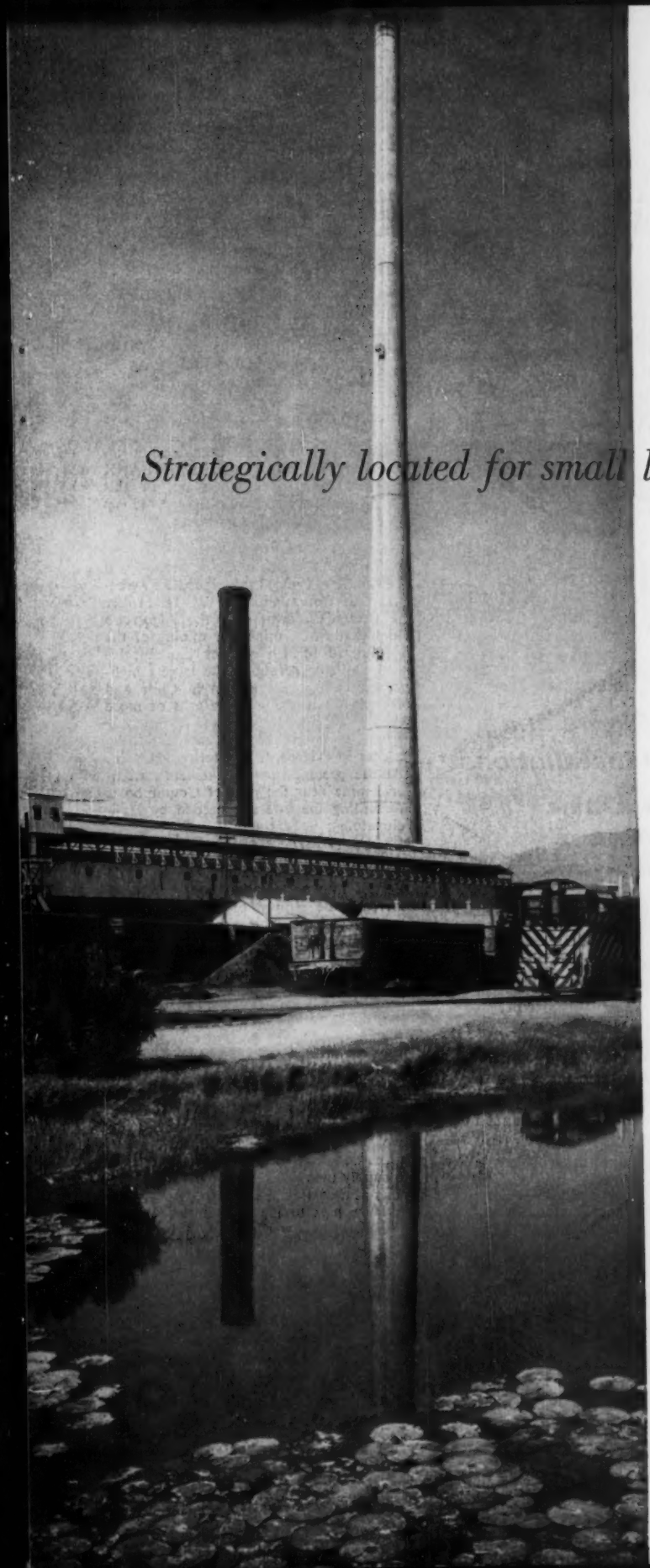

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See management
at above locations
or write to main office.
American Smelting and
Refining Company,
Ore Purchasing Department,
120 Broadway,
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58-54

ASARCO

CHILE

The French members of Peñarroya's board of directors who were recently in Chile called on the Secretary of the Treasury to announce that the output of Cia. Disputada de Las Condes' mill will be increased from 12,000 to about 25,000 tons of concentrate per year. As part of that increase, the capacity of the underground mine has already been doubled. Peñarroya is also going ahead with the reconstruction of the Chagres smelter where the concentrates from the Disputada and El Cobre mills, both located in central Chile, will be smelted.

Cia. Minera Tamaya is producing between eight and nine tons of mercury a month from its Punitaqui Los Mantos mine and mill. The low-grade ore is floated to obtain a 25% Hg concentrate, mixed with 20% lime, dried in a rotary dryer and then sublimed in cast iron retorts of which there are four to a furnace. At present three furnaces are operating: two treating concentrates and one high-grade ore. The same company is also operating its 400-tpd mine and mill at the old Tamaya camp, one of the oldest and most famous Chilean high-grade copper camps, which lies some 40 miles to the North of Punitaqui. Its subsidiary, Cia. Minera Aisén, is concentrating its lead and zinc ores in Aisén province, six hours flight to the south of Santiago.

CHECK THE NEW

Connellsville

MINICAGE

(TRADE MARK)

The Service Elevator for Preparation Plants and Underground Installations

- REDUCE DOWN TIME
- ELIMINATE FATIGUE
- SPEED UP MAINTENANCE

This all-steel Connellsville MINICAGE with 1000 lbs. and up capacity travels the outside wall of an existing preparation plant . . . or may be designed for inside a future-planned facility. Operates automatically at speeds of 50 to 75 feet a minute.

The sturdy fabricated steel structure with pantograph-style gate is mounted in place and safely attached to wall. Drive assembly at top of structure is coordinated with the MINICAGE and level doors by a control system. Wall openings at levels have hinged safety doors.

The entire Connellsville MINICAGE installation complies with federal and state mining laws.

For additional information and details on the Connellsville MINICAGE and other elevators, cages, hoists and conversion units, write for Bulletin No. 200.

Raising Production

SINCE 1901

Connellsville MANUFACTURING

CONNELLSVILLE, PENNSYLVANIA

Because of government help, Compania Salitrera de Tarapaca & Antofagasta will be able to increase the capacity of its Victoria nitrate plant from 12,000 to 18,000 tons of sodium nitrate per month.

The expansion at Salitrera de Tarapaca, as well as an expansion at Acerias Paz del Rio, S.A., will be done with staff members of Koppers Co., Pittsburgh, who will advise and aid with management, planning, finance, production, marketing and plant maintenance.

Anglo-Lautaro Nitrate Co. also plans to improve and increase the capacity of its activities by spending some $14-million as follows:

A fully mechanized loading port for nitrate at Tocopilla; increase of power plant capacity; Iodine and boric acid plants; sodium sulphate plant; and five new solar evaporation tanks.

Anglo Lautaro has obtained an increase in its loan from the EXIMBANK from $16- to $20-million but of this credit the company had already used (up to June 30) about $10-million.

Delegates of Cia. de Acero del Pacifico, owners of the steel mill at Huachipato in southern Chile, have signed an agreement in Rotterdam with W. H. Muller & Co. N.V., owners of the Algarrobo high-grade iron mine, for mining of the deposit to furnish ore for the Huachipato mill. Algarrobo is the largest high-grade iron deposit known in Chile and contains some 100-million tons of more than 60% Fe, low in S and P. The ore from Algarrobo has a short and easy access to the sea at the port of Huasco. At the present time, Bethlehem's Romeral mine near the port of Coquimbo is furnishing the iron ore needed by Huachipato.

The Mining Credit Bank is transforming the old silver-cyanide mill of Elisa de Bordos into a floatation copper mill to increase the supply of copper concentrates for the Paipote smelter. It is also redesigning the crushing plant of the Punta del Cobre mill, only five miles from Paipote.

In connection with the small copper and iron mines of the provinces of Atacama and Coquimbo, the construction by Empresa Nacional de Electricidad of a 15,000-kw steam plant at the port of Huasco will be very important to future development. The steam plant will burn Chilean fine coal and will consist of two 7,500-kw units. Until now, most mines and mills in the two provinces had to supply their own power through diesel units at a cost of about 3¢ per kw-hr due in large part to the high duties on oil. The Huasco power plant will be interconnected with the Paipote-Copiapo power plants in the north and the Molle hydro and diesel system in the south (Coquimbo Province).

COSTA RICA

International Iron, Inc., a newly-formed company, headed by A. W. Dugan, of Houston, Texas, has announced a new iron discovery on the west coast of Costa

Tires replace tracks for underground zinc-ore loading at Eagle-Picher mine

Production boosted 40%, repairs cut in half

In the sprawling, honeycombed caverns of a zinc mine 300 feet below ground, two rubber-tired Michigan Tractor Shovels are loading out 40% more ore than the crawler loaders they replaced—proving mobility is an asset anywhere—even below the earth's surface.

Owner Eagle-Picher Company's switch to Michigans here at Galena (Ill.) has produced a number of important advantages. First, they eliminated an hour of waste time every day. "It used to take crawlers 20 minutes just to creep a mile or so from our central service area to the work sites," explains Mine Supt. Ed Huoy, "and 20 minutes at the end of the day to come back again." The Model 175A Michigans make the trip, either way, in five minutes.

Triple output on scattered loading

"Also, in certain areas of the mine where loaders must carry shot rock as much as 100 ft to truckload, the rubber-shod machines often do three times the work of crawlers," Mr. Huoy continues. "The same advantage holds true when loads must be taken in succession from different headings in order to get the desired 3% blend of zinc for processing."

One Michigan keeps five trucks busy

Michigan output is high on straight loading too, according to General Supt. Harold Haman. "With trucks on average one-way haul distance to the crusher of about one mile," he says, "one Michigan loads out as much as 100 tons per hour. It alone keeps five 8-ton trucks busy. Each 8 ton load takes a Michigan three passes, two to four minutes. A typical day yields 1,400 tons of rock. Previously, with crawler loading, our top output was 1,000 tons. The daily increase, 40%."

Maintenance costs 50% lower

According to Robert Haffner, manager of Eagle-Picher's Illinois-Wisconsin operations, "Michigans not only load out more rock than the crawlers, but their cost of maintenance per ton loaded *is about half*. Shot rock, so rough that tracks and track frames required numerous overhauls, have been comparatively easy on tires. Re-capping is needed only every 1,000 hours or so.

"Before Eagle-Picher settled on Michigans, we tried other machines," continues Mr. Haffner. "After careful consideration, we decided Michigans had the sturdiness, mobility, and productive capacity we needed. We now do all loading here in Galena—and at our Shullsburg (Wis) mine—with Michigans. Four of them. So you can see how much we like them!"

Michigan is a registered trademark of
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Construction Machinery Division

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Costa Rica *(Continued)*

Rica in the province of Guanacaste several miles from the Pacific Ocean.

The U.S. company has been exploring with National Exploration de Costa Rica for a number of months.

The chief of the geological section of the Ministry of Agriculture & Industries, Dr. Cesar Dondoli, reported that there are large deposits of magnetite and ilmenite in the Puerto Viejo area of Limon province.

Chemical analyses of the ore, show that the titanium content ranges from 5.56 to 6.73%. Several U.S. companies reportedly are interested in the ore, which, after separation from the sand, has a value of about $14 a ton, but no production contract has been signed.

MEXICO

Mexican mining in 1959 showed a holding action against unsteady world prices and U.S. import restrictions. Production figures remained approximately the same as those in 1958 but the value of production and exports improved a little with the firming up of prices later in the year.

For example, total zinc production through September was $53.3-million and most of this was exported. Lead production totalled $38-million and $27-million was exported. Copper production was $28.3-million and some $21-million-worth was exported.

All of the figures, except zinc, were just slightly over last year's. Zinc showed a considerable value increase.

Sulphur production for 1959 will reach an all-time high with more than 1-million tons produced. This will bring in some $22-million and is fast becoming one of Mexico's most important export items.

Aside from production figures, which showed no startling changes, Mexican mining did have an interesting year on the political and on the industrial side. The Mexican government, under President Adolfo Lopez Mateos, is pushing for more mine industrialization to get more of an export value and to save the country imports of metals needed in local industry.

The government has ordered a zinc plant to produce 70,000 tpy of zinc to take a big chunk of the country's free zinc supply. The government is also pushing ahead on a $1-million pilot plant to get phosphorus from low-grade rock via a new process. Asarco announced plans for the construction of a plant to produce extremely special high grade zinc.

The government is also pushing ahead with two pilot plants for the processing of uranium ores. Dow Chemical, under its Mexican subsidiary, La Dominica, is building a fluorspar flotation plant near the U.S. border. In one of the big news breaks of the year, Alcoa announced that it was going ahead with a $20-million aluminum plant in the State of Vera Cruz. The alumina will be imported but the Mexican government is looking for a way to use Mexico's low-grade bauxite.

There were few, if any, new mines opened up in Mexico during 1959 and no expansions. This was caused by the world market situation which was aggravated by the fact that the Mexican government is still clinging to its system of heavy taxation of minerals exports. But, there is a trend towards new mining ventures in nonmetallic minerals. For example, U.S. Gypsum is putting in a $5-million operation in the state of San Luis Potosi and at the port of Tampico to ship 1-million tons of gypsum yearly.

On the political side of the Mexican mining ledger there are some significant changes. For one, the government is restlessly promoting what it calls "Mexicanization" of Mexican mining. Some 86% of Mexican mining production is in foriegn hands. This is becoming more and more politically embarrassing for the Mexicans and there will be continued efforts to come up with some sort of plan to get more Mexican capital into the act. But Mexican investors don't like the low returns from mining compared with high returns from real-estate.

Eduardo Bustamante, the new Minister of the new Ministry, National Patrimony, has said in public that Mexicans are going to get more into mining—or else. This restlessness is visible in a series of attacks against the U.S. companies which control all sulphur production in Mexico. The government has been jiggling with Article 27 of the Constitution, paving the way for more moves into mining. And the government has been placing more and more minerals reserves under the "national patrimony." Example of this was seen in the phosphate reserves of Lower California which are being put under government control.

Mexico's National Patrimony Secretary announced recently that the country was going to push local tin production to become self-sufficient, thus cutting some $1.6-million worth of imports per year.

The Secretary said that the government would fix a price and give guarantees according to the laws protecting new industries to make tin extraction and production "very attractive."

Plants are planned for local production of Grade A tin. Right now, Mexico only has one plant producing tin—in the State of San Luis Potosi. Mexico has some reserves of tin but it has never been known that there was enough in quantity to make the country self-sufficient.

Mexico consumes about 1,200 tons of tin per year; 800 tons are imports, the rest being produced locally.

PERU

Peru's most important mining news was the completion of U.S. $230-million Toquepala project of the Southern Peru Copper Corp. The first shipment of blister copper from the Ilo smelter was made Dec. 22, through the Port of Ilo, to the U.S. on the *Ciudad de Guayaquil* of the Flota Mercante Grancolombiana. The shipment amounted to some 730 tons of copper produced to test the various facilities and installations of the project, before regular production starts in January. Production is expected to reach 400 tpd in a few months.

The Toquepala project was officially started in April 1956 and has been com-

Calgary Symposium Seeks Unified Arctic Data

THE FIRST international symposium on arctic geology may have "ice-breaking" results in promotion of fuller and faster flow of scientific data between circumpolar countries and all institutes with interests in the Arctic.

That's the hope of the Alberta Society of Petroleum Geologists, whose plans for the international gathering started taking shape early in 1959. Prime objective of ASPG is to bring about dissemination and better coordination of scientific information pertaining to the arctic. Such information now is scattered to the poles; much information lies dormant for one reason or another and other information has grown a beard by the time it appears as a formal report. While much information exists, no immediate method of locating it is available. This is the situation in the face of a great increase in interest in the arctic, not only evidenced by Canada but by other circumpolar countries.

This is not a matter of competitiveness. The ASPG officials observed in response to questions by E&MJ that "there's no question of competition; it is just a matter of putting people on the right track through information."

While ASPG recognizes that putting an end to the informational muddle will bring advantages, the organization concentrates solely on dissemination of information as completely divorced from commercial significance of such information.

The informational gaps are about as vast as the region concerned. Lacking are such basic items as circumpolar geologic and tectonic maps. These—as preliminary maps—are now in the process of compilation by the symposium committee.

The symposium was held in Calgary under sponsorship of ASPG on Jan. 11-13. D. W. R. Wilson (Shell Oil Company of Canada Ltd.) served as General Secretary of ASPG's arctic symposium committee.

Delegates brought with them to the symposium both geological and tectonic maps of their respective Arctic areas together with the latest formation correlation charts. It is hoped that this material can be put together in revised up to date order. It is hoped further that a chart can be compiled, as a result of information submitted to the symposium, showing depth values to the bottom of the Arctic Ocean.

INTIMATE MIXING speeds reaction in one of eight 3384-gal. uranium oxide strip tanks equipped with turbine-type LIGHTNIN Mixers. Shown here is Baxter Blitz, Plant Engineer, Kermac Nuclear Fuels Corporation, Grants, New Mexico. For complete mixer details, request LIGHTNIN Catalog B-102.

"4700 hours of mixing . . . no trouble"

"Not one of our eight LIGHTNIN Mixers has given us any operating difficulties," says Plant Engineer Blitz.

This was no mere specification-matching choice of mixer. MIXCO people went to Kermac and came home to our lab with samples, plus answers to plenty of questions they'd asked.

Later, when they recommended 5-hp LIGHTNIN Mixers for these strip tanks, there was no question about efficient, dependable mixing—the kind Kermac needs and bought.

This is the way MIXCO solves any fluid-mixing problem you can name so that it *stays* solved. Any materials, any tank size or shape, any power level from ¼ to 500 hp.

When *you* see a MIXCO recommendation, you'll know precisely the balance of horsepower and speed you'll get . . . the exact mixing action . . . and how long it will take to accomplish the mixing results you want.

No loopholes. We guarantee, unconditionally, that with our recommendation you can predictably blend ores in pulp form, mix slurries, condition feed for flotation cells, speed chemical reactions (as Kermac is doing), or solve other fluid-mixing problems—the one which you perhaps have in mind now.

Let us know about it. Call in a skilled LIGHTNIN Mixer representative now. He's not far from you. Look him up in Thomas' Register—or write directly to us.

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Peru *(Continued)*

pleted five months ahead of schedule. The project called for the construction of 131 mile of railroad, a huge ore crushing plant and concentrator at the mine site, located at an elevation of nearly 11,000 ft in the Andes foothills with a capacity of 30,000 tpd of ore, the erection of a modern smelter at Ilo to process 1,250 tpd of concentrates into 400 tons of copper, a 44,000-kw steam power plant at the smelter, and the many other installations required for a modern industrial operation located on the deserted and arid coast of south Peru.

The Santander mine, a lead-zinc mine with some silver and copper, went into production in January 1959. The mine is owned two thirds by the St. Joseph Lead Co., of St. Louis, Mo., and one third by L. J. Rosenshine and the estate of the late Martin J. Heller. The property is located at 15,000 ft in the central Andes of Peru. Ore estimates are above 2.-million tons with exploration being carried out to prove further reserves. Daily mine production is 500 tons of lead-zinc ore. Mining is by the open-pit and the ore hauled to the selective flotation mill. Concentrates are hauled by truck to the port of Callao for shipment.

Acari iron ore mine, owned by Pan American Commodities, of Lima, went into regular production in August. The property is located east of the iron deposits of the Marcona Mining Co., owned by Cyprus Mines Corp. and Utah Construction & Mining Co. Development and operation of Acari was carried out by the Wells Overseas Ltd. (subsidiary of Wells Cargo Inc.), with a loan of approximately U.S. $9-million granted by the American Overseas Finance Corp., and a later U.S. $4-million loan as advance payment on ore granted by the Ore Marketing Inc. of New York. Production is running at 120,000 tons of ore a month.

The Buenaventura mine is completing a 200-tpd lead-zinc concentrator.

Compania Minera Condor, located near Pampano, 100 km east of Pisco, completed a 120-tpd flotation mill producing 27% Cu copper and 10 oz Ag per ton.

The Yauricocha mine of Cerro de Pasco Corp. was closed down at the end of December as a result of fire that broke out in one of the shafts. The mine, located in the province of Yauyos, Department of Lima, and 50 miles south of La Oroya, has a monthly production of about 18,000 tons of copper ore. Ore is shipped by cableway and rail to Pachacayo and then to the smelter at La Oroya. The fire was put out by flooding the mine with water pumped from Lake Yauricocha. Operation was due in late January.

The Santa Barbara mercury mine in Huancavelica increased production 50% and exports in 1959 amounted to 3,000 flasks.

The first shipments of manganese ore, running 57% Mn, were made from the Perene area in eastern Peru. The owner is hampered by transportation problems and lack of capital to carry out more extensive development.

The continued low price of lead and zinc on the world market, the U.S. quotas, slowed down mine expansion; but, on the other hand, only a few small producers closed down.

Preliminary production figures for 1959 were as follows:

	Tons
Contained copper	48,000
Contained lead	120,000
Contained zinc	156,000
Contained iron ore (60% Fe)	3,300,000
Contained silver (fine oz)	24,500,000

VENEZUELA

Negotiations for building an aluminum reduction plant in Venezuela are proceeding between the government and Reynolds International, Inc., J. Louis Reynolds, chairman and chief executive officer, reports.

A similar announcement was made in Venezuela after meetings between Mr. Reynolds and Dr. Juan Pablo Perez Alfonzo, Venezuela's minister of mines. Dr. Alfonzo praised the proposal and said it was being seriously considered by his government.

For Flotation!
Triangle Brand Copper Sulfate
...is a flotation activator for lead, zinc and uranium ores that is 99% pure and available in several sizes from nearby stocks.
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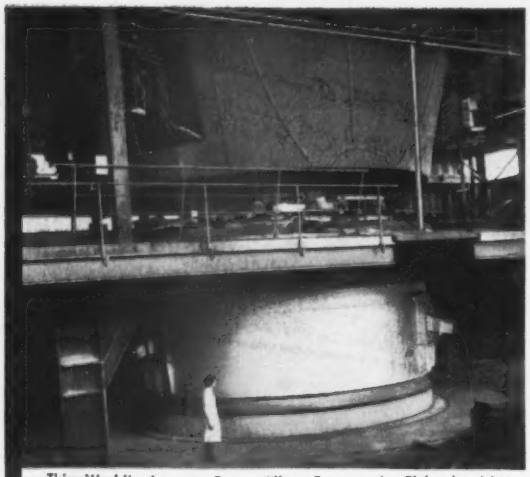
ELECTRIC SMELTING FURNACES



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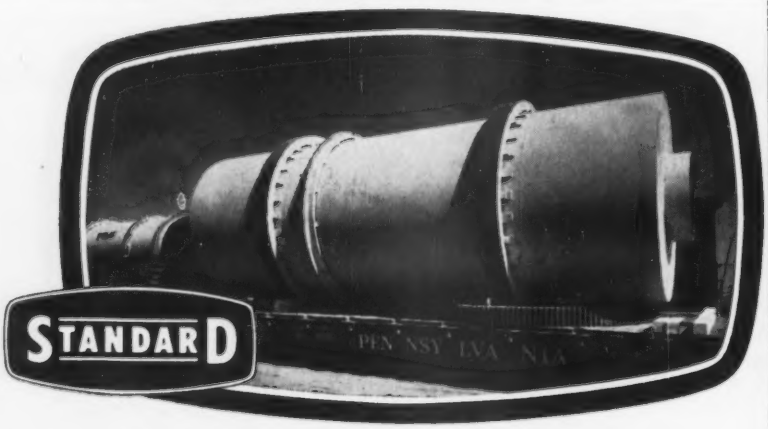

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Venezuela *(Continued)*

The project involves importing bauxite and reducing it to pure aluminum by using power from the government's hydroelectric plant which is being constructed on the Caroni River.

Tentative site for the proposed plant is in the Guayana region. In an interview with Venezuelan newspapermen, Mr. Reynolds predicted great possibilities for the industrialization of the area.

Reynolds International has its headquarters in Hamilton, Bermuda.

IN AFRICA

MOROCCO

The stark Rif Mountains in the northern part of the country, superficially exploited while under Spanish protectorate up to 1956, are now attracting the attention of Moroccan and foreign mining companies—U.S., French and German investors have voiced interest in developing zinc, lead and graphite mines in the Rif.

Small Spanish companies are looking for outside capital to share their concessions in the Rif. Up to now, the companies have held a monopoly in the area, but have invested little in its development. Under independent Morocco's new mining legislation, companies must obtain government approval on their work every four years.

The first joint-venture of this kind is Societe Miniere d'Alhucemas, a marriage between the Spanish Mines du Rif and Zellidja Lead & Zinc Co., with stock held by the government and Newmont Mining Corp.'s.

Societe Miniere will investigate lead and zinc mines in the Rif Mountains near Alhucemas on the Mediterranean, 110 miles east of Tangier.

On the outskirts of Rif Mountain village of Xauen, 50 miles southeast of Tangier, teams from the government geological survey department have been making studies of lead and zinc occurrences. French and Moroccan investors have expressed interest in obtaining concessions in this area.

Bidding has been opened on one vermiculite and on two graphite mines on the Mediterranean, 55 miles east of Tangier. The Spanish firm Mauretenia, A.A. holds the concession for this 25 sq mile area at present. Due to the lack of mining equipment, Mauretenia produces only about 30 tons of graphite monthly—preliminary studies show that the mine can yield 1,000 tons a month.

The government and several European buyers of Moroccan phosphates, associated in a company called Sutrima, have completed the foundation work for the establishment of a triple-superphosphate industry.

The plant is to be located at the southern port of Safi, which is linked by railroad to the important phosphate deposits at Louis Gentil, 50 miles inland.

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The Turbulaire-Doyle Scrubber is unique in its high collection efficiencies and low maintenance requirements because it incorporates a jet-action design that assures a far more thorough scrubbing action—yet requires no complex mechanical systems that boost maintenance and repair costs.

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This Jet-Cone in the throat of each Turbulaire-Doyle inlet tube causes a sharp increase in the velocity of the incoming gases—the velocity reaching maximum at the point where the dirt-laden gases impinge upon the scrubbing liquid.

RESULT: ***unusually deep penetration of gases into the scrubbing fluid for more complete cleansing of all suspended particles—even those in the fume range.***

Yet there are no moving parts—nothing to require frequent repair or replacement!

ILLUSTRATED ABOVE: Two-stage rubber-covered units remove dust and fume from gases at wet process phosphoric acid plant. Capacity: 64,000 CFM.

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- **NEGLIGIBLE MAINTENANCE** no moving parts to wear or corrode—no "plugging" problems.
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Morocco *(Continued)*

The cost of the plant was estimated at about $13-million and its annual capacity at 200,000 tons.

Phosphate deposits lying near the surface and averaging over 82% after simple washing have been discovered recently at Louis Gentil and Khouribga, important field 100 miles east of Casablanca. There are known reserves of 100-million tons at Khouribga and still undetermined reserves of several billion tons at Louis Gentil. Morocco ranks second in world production of phosphates.

Moroccan Phosphate Office, a state monopoly, also plans to build subsidiary plants to produce sulphuric and phosphoric acid, necessary for the production of triple-superphosphates.

SOUTHERN RHODESIA

Copper developments in 1959—Messina (Transvaal) Development Co., in March, began construction of development of the old Alaska mine at a cost of $1.4-million. Early reserve estimates are 5-million tons, 1.8% Cu. Annual output is expected to be 2,600 long tons of concentrate which will be smelted and refined in Messina's new $2.1-million plant. Refinery construction was started in December and when onstream will treat the concentrate produced at the old Mangula property (3,000 tpd ore).

A geophysical survey carried out close to the Khami Dam outside Bulawayo indicates the presence of sufficient copper for a large-scale mine. Japanese firms operating in the area are reportedly interested in this development; so are Union and Rhodesian mining houses.

Gold in 1959—In October, Rio Tinto purchased the Patchway and the Old Ben mines and were granted exclusive licences over an adjacent 24-sq mile area. In December, Rio Tinto purchased control of the country's largest gold mine—the Cam & Motor property, for $7-million.

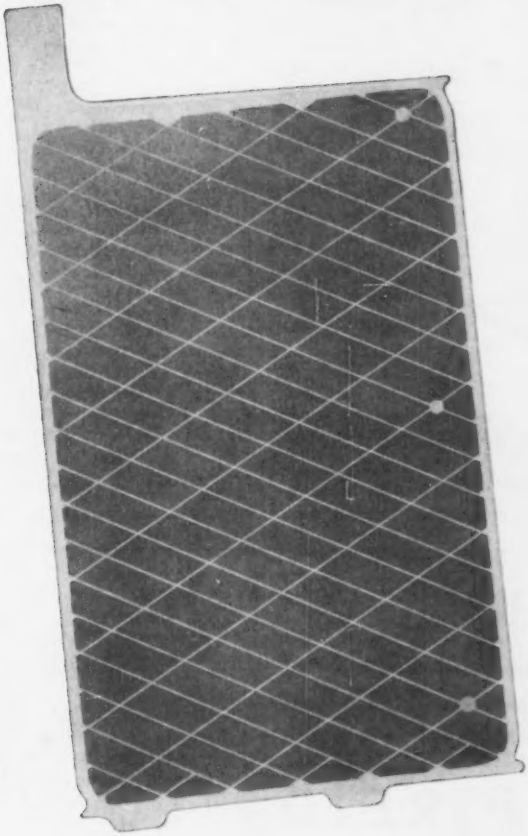
Nickel—The Japanese are to build a $2.8-million nickel smelting and refining plant at Bindura—Shimura, Kako Chemical Processing Co. has signed an agreement with Anglo-Vaal Ltd., the owners of the Trojan Nickel Mines Ltd., making Anglo-Vaal partners in the venture. Production will be sent to Japan.

NORTHERN RHODESIA

Copper developments in 1959—A record tonnage was produced in the Copperbelt during the first 10 months of 1959 and its value was almost double the figure for the same period in 1958. To the end of October 1959, 591,000 tons of blister and electrolytic copper valued at $302,400,000 had been produced. An estimate of total 1959 production is $361-million which compares favorably with 1956's $364-million at a time when copper prices were high.

In April, Bancroft came back into pro-

NEW GOULD *SILCONIC* PLATE Increases Battery Life 25%-FREE!



A vital contribution to motive power batteries, Gould's NEW Silconic Plate prevents grid corrosion, the most common cause of battery failure.

Sound, tested and proved, the principle is simply this: Gould introduces silver and cobalt into active materials of the positive plates. The silver and cobalt migrate to—and collect on—positive grid members, forming an insoluble oxide surface impervious to acid and oxygen attack. The longer the battery operates, the deeper the silver-cobalt penetrates into the grid metal, thus greatly prolonging life. In applications where batteries are idle for periods of time, Gould's Silconic Plate prevents migration of materials to the negative plate, effectively reducing self-discharge within the cell.

Further overall strength is achieved when arsenic is added to the antimonial alloy of the plate, resulting in an extremely dense, homogeneous grid free of flaws. This new physical and chemical strength—together with Gould's compact battery design—add up to the best motive power battery you can buy. Write today or call your local Gould representative. He's listed under "Batteries Industrial" in the yellow pages. Gould-National Batteries, Inc., Trenton 7, N. J. In Canada, write to Gould-National Batteries of Canada, Ltd., 1819 Yonge Street, Toronto, Ontario.

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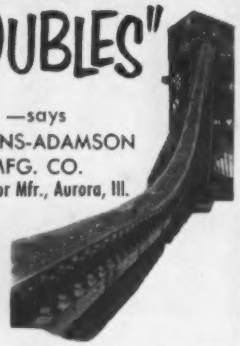

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N. Rhodesia *(Continued)*

duction after being dewatered, and had attained its 150,000 tons per month ore feed capacity by the end of the year (50,000 long tpy copper). Ore reserves are estimated at 104.9-million tons, 3.82% Cu.

Development of a new orebody at Mufulira to be known as Mufulira West will raise the mine's output by 50% (88,056 long tons in fiscal 1959). The property should be producing by mid-1962 and is estimated to cost about $44.8-million.

Development also began on a new orebody at Chibuluma and is expected to yield ore in 1963, adding 4,000 long tpy to Chibuluma's production (19,236 long tons in fiscal 1959).

British South Africa Co., which owns all mineral rights in Northern Rhodesia, granted Rhodesian Selection Trust prospecting companies a 10-year extension (from 1961 to 1971) on their exclusive rights on over 47,600 sq miles.

Estimated 1959 Production
(January to November)

Southern Rhodesia

	Short tons
Copper	10,841
Coal	3,790,638
Chrome	491,069
Asbestos	111,293
Also add:	
Gold (fine oz)	519,916 oz.

Northern Rhodesia

	Short tons
Copper	
Blister	170,322
Electrolytic	375,808
Concentrate	256
Others	1,217
Total copper	547,603
Manganese	54,712
Lead	14,784
Zinc	30,573
Cobalt	
Metal	25,736
Others	193,195
Total cobalt	218,931

THE UNION OF SOUTH AFRICA

The Union's minerals recorded an excellent year with gold at 20-million oz, a new high; silver with over 2-million oz improved by 12% on the previous year; Copper, 55,000 tons; chrome ore 748,000 tons; iron ore, 3.15-million tons; manganese ore 1.06-million tons; pure tin, 15,000 tons; asbestos (all types), 184,000 tons. Copper production was still below the previous year, picking up substantially toward the end of the year, due to the U.S. copper strikes.

The upward surge of production in the Free State was perhaps the most striking single factor in the industry's performance last year. Output from all the mines rose by almost a third, from 4,329,411 oz to the record level of 5,581,785 oz. This means that the mines in this group increased their contribution to the nation's foreign exchange resources by about $43,680,000. By the year end, production was running at an annual rate of more than 6-million oz, worth about $210-million.

The trend of Free State production should remain strongly upward. None of the mines has yet reached its maximum potential and most of them are still far from planned output levels.

De Beers—largest producers of natural diamonds, has announced manufacture of synthetic diamonds—"the climax of a program initiated in 1955." From first production of a synthetic diamond in September 1958, the company began intensive study of methods and characteristics, working toward continuous production of a consistent stone.

Harry Oppenheimer, chairman of the firm, noted that the synthetic diamonds, manufactured for use in grits for grinding, are of the same type as those manufactured by General Electric Co.

IN AUSTRALIA

No new major mine went into production in Australia during 1959, but the

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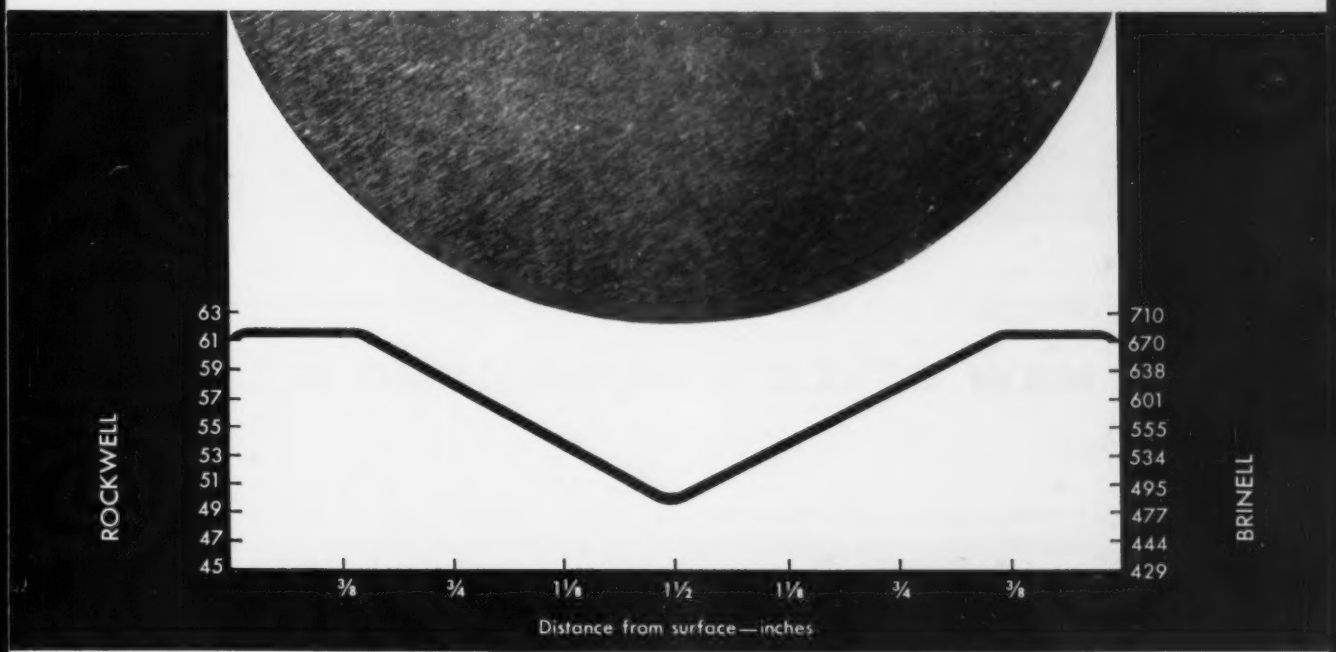

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Spectrographic analytical control of elements in steel making processes and controlled heat treatment assure the desired metallurgical grain structure which produce the type of hardness required for maximum wearing qualities.

Performance reports on Naco solid cast alloy steel grinding balls from mills now using them have been universally favorable—both in lasting qualities and impact absorption.

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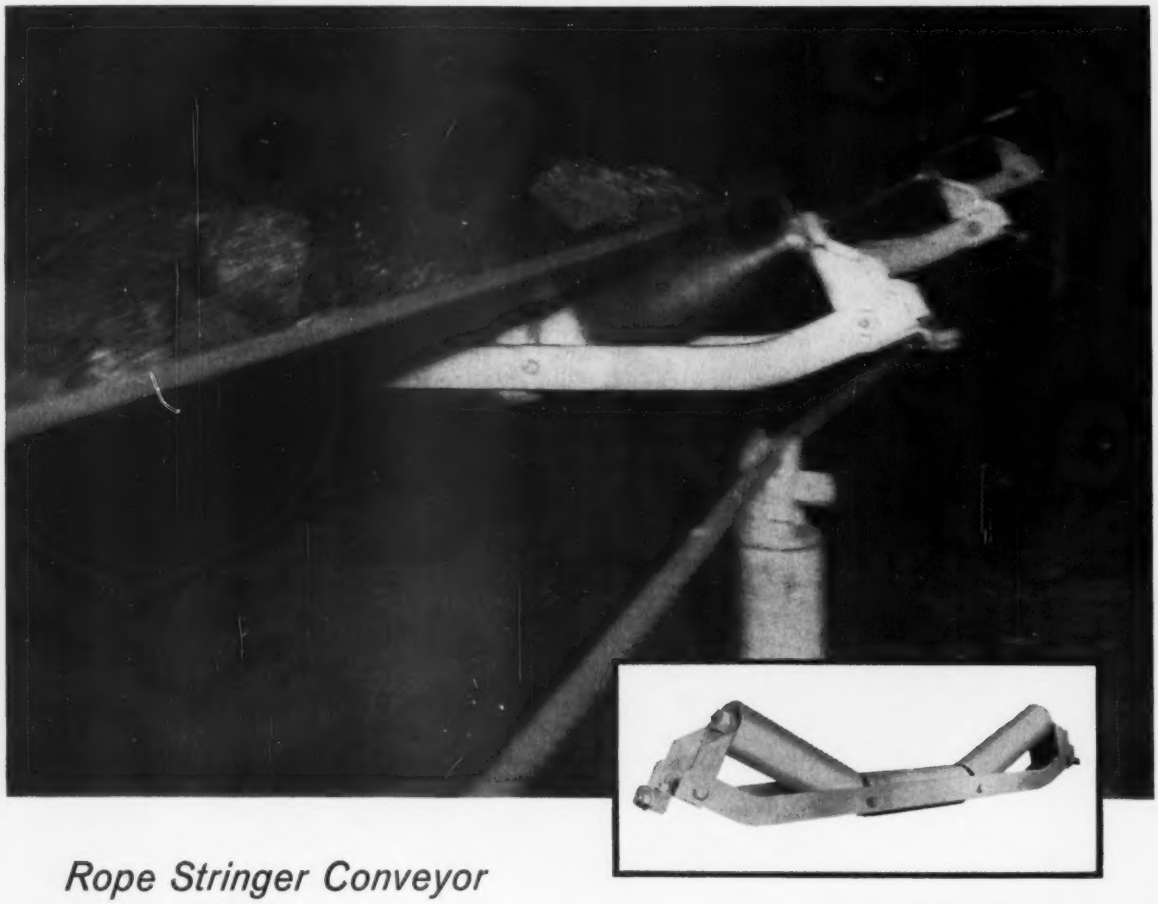

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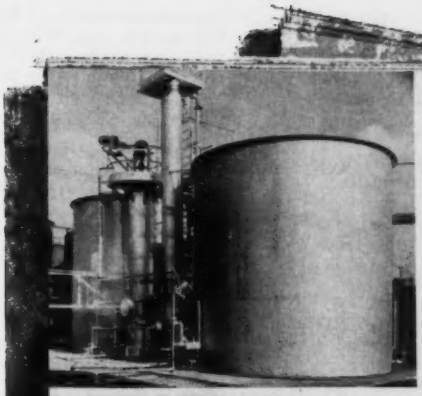

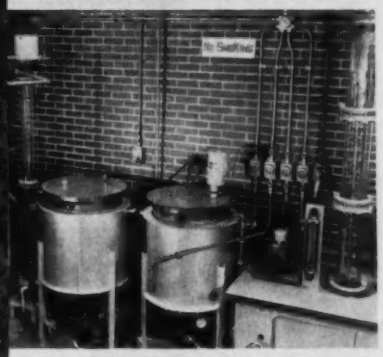

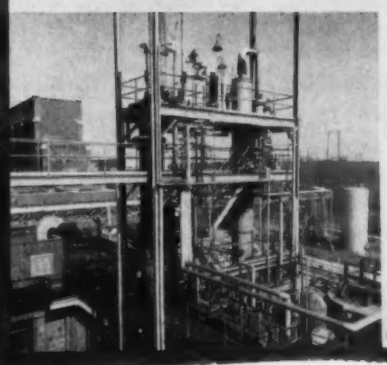

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Australia *(Continued)*

new electrolytic copper refinery in Queensland come onstream in June. Located at Townsville, the refinery is owned by Asarco-controlled Copper Refineries Pty. Ltd. and has an annual capacity of 40,000 tons of cathodes which is to be expanded to 60,000 tons and higher in the immediate future. At Mt. Isa, copper-smelting capacity is being raised to 60,000 tpy.

1959 saw the completion of a new lead refinery at Port Pirie, South Australia in a plant incorporating continuous vacuum de-zincing and caustic refining. Rotary furnaces were installed for de-leading copper by-products using a process developed at Port Pirie.

At Cockle Creek, New South Wales, the construction of the sinter plant for the vertical zinc-lead blast furnace commenced.

Major mining expansion was virtually limited to Mt. Isa. The mine reached a target level of 8,000 tpd ore in October of combined lead-zinc-silver and copper ores. The new shaft was started down; it will cost several million and take several years to complete.

Mt. Isa is introducing a new flowsheet into the lead-zinc circuit. Disposal of copper concentrates in 1960 is now assured as a result of a contract with Japanese buyers worth about $10-million. The smelter is being enlarged to handle the present excess milling capacity.

The tallest stack in Australia is being erected at Mt. Isa by Rust Engineering Co., Pittsburgh, Pa., at a cost of about $575,000. The stack, more than halfway up, at year-end will top out at 500 ft and will have a brick lining applied on concrete using acid-proof brick backed with fiber-glass insulation. The stack is 35½-ft dia at the base and tapers to 17-ft dia at the top. More than 1,697 cu yd of concrete and 180 tons steel are needed to complete the erection.

Mt. Lyell in Tasmania, will accelerate overburden removal to increase copper ore production. First step of a five-year plan is to strip 2-million tons of waste in the next two years. A drive and drilling program are planned for the Crown Lyell No. 2 orebody which is considered as a possible source of high-grade ore.

North Kalgurli Ltd., Western gold producer, expects its current operations to produce the same tonnage and value as in the past fiscal year when profits were £161,719. Reserves are 2,283,266 tons, 5.42 dwt/ton.

The beach sand plant of Westralian Oil Ltd. is reaching production after a successful shake-down. The plant has a capacity for 100,000 tpy, but it is doubtful whether or not more than 50% of it will be used until prices and orders improve.

Australian-controlled Emperor Mines Ltd. on Fiji expects its newly redesigned reduction works will reduce operating costs considerably. The mill treated 177,159 tons for 75,991 oz Au last year. Reserves are 862,000 tons, 8.7 dwt/ton.

At Wittenoom Gorge in Western Australia, production of crocidolite increased through the expansion of the plant and underground development. Output rose 40% over 1958.

Australia Atomic Energy Commission has stopped purchasing beryl, pending a decision on stockpiling. Mining officials in Western Australia which produced 130,000 lb of beryl in the year ending June 30, 1959, said they hoped that relaxation of the government's ban on sales would stimulate competition.

Here are the preliminary estimates of 1959 output as prepared for E&MJ by J. W. Morgan, chief mineral economist, Bureau of Mineral Resources, Geology and Geophysics, Canberra, A.C.T., Australia:

	Tons
Copper	93,000
Crocidolite	16,000
Iron ore	4,030,000
Lead	315,000
Manganese ore	75,000
Rutile	79,000
Ilmenite	79 70,000
Zinc	250,000
Zircon	100,000
Gold (fine oz)	1,068,000 oz

du Verre

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Design engineers planned for trouble-free, corrosion-free operation at this metal refining plant. They know the waste gases containing a high concentration of free wet chlorine and other highly corrosive elements would make short work of metal or rubber lined components. That's why they specified the really dependable, corrosion-free du Verre #22 for all parts of the ventilating system — collectors, vent pipes and venturi exhausters.

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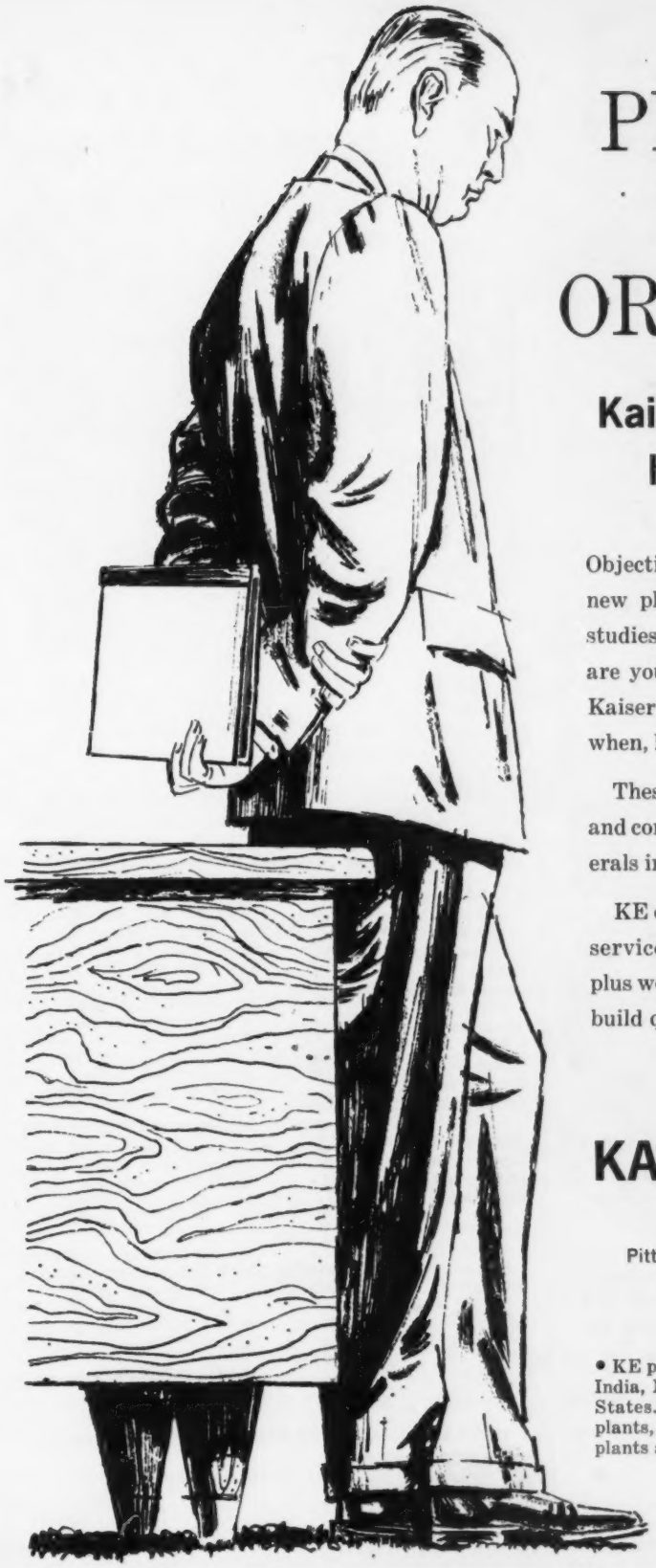

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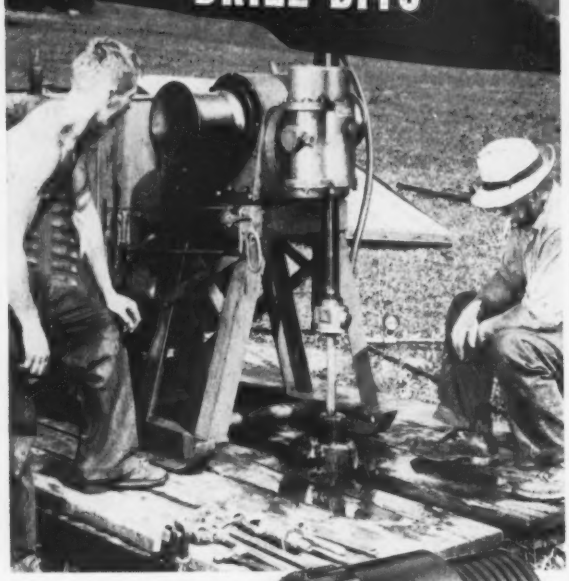

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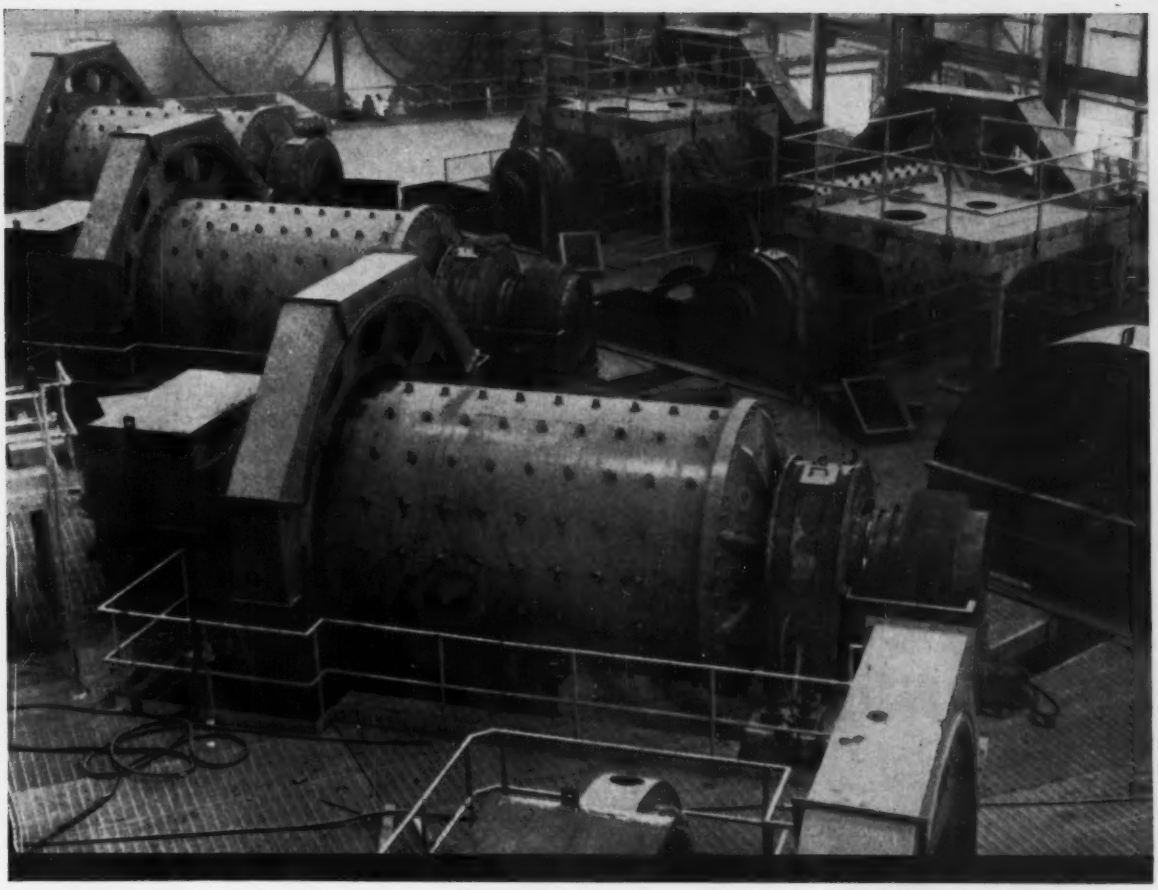

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IN EUROPE

USSR

Tass recently reported that a testing rig located in the Baku area (Azerbaijan) and using an electrically driven bit had reached a record depth of 12,302 ft.

The Soviet news agency went on to say that the drilling log clearly showed that, at greater depth, the electric drill was more effective than the turbine drill. drill.

At depths greater than 9,842, said Tass, the electric drill advanced 51.48 in. faster than the turbine drill that was being operated nearby. Soviet experts are confident that the electric drill will show better comparative results at even greater depths.

According to the Zebtral Administration for Statistics of the Council of Ministers of the USSR, 1959 output levels for the Soviet metallurgical industry "was surpassed by considerable amounts."

The actual output figures were quoted as follows: pig iron, 43-million metric tons; steel, roughly 60-million metric tons; and about 40-million metric tons of rolled products.

ITALY

During the first nine months of 1959, Italy produced 56,690 metric tons of aluminum pig compared to 47,517 metric tons for the same period of 1958, according to the Agenzia Economica Finanziaria of Rome.

However, mercury production dropped from 1,665 metric tons in 1958 to 1,109 tons last year—also based on nine month figures. Mercury ore production for the same period dropped from 234,668 metric tons in 1959 to 171,769 metric tons in 1959.

IN ASIA

JAPAN

Compania Metalera Nitto recently signed a contract with the Bolivian firm, Chacarilla Copper, for the purchase of nine copper mines located at Aroma in La Paz Department.

Nitto has taken over a group of former Chacarilla Copper mines and, according to a company official, is ready to invest about $10-million to develop these mines in a program that will be progressively expanded.

According to the Japanese Titanium Society, 1,173 metric tons of titanium sponge and 1,665 tons of titanium slag were produced during the first six months of 1959. Exports during this period totaled 880 tons, of which 867 tons were destined for the U.S. and 13 tons for Europe.

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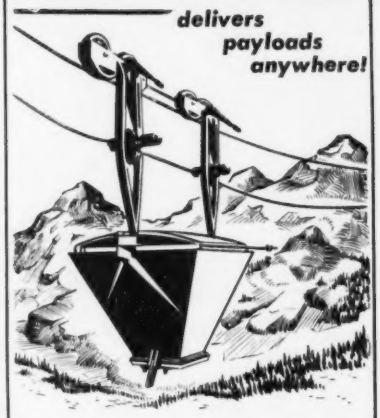

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PHILIPPINES

The Nippon Mining Co. has sent engineers to investigate reports of good copper showings by Apayao Mining Co., Malitao — Bureau of Mines' geologists have reported that the area is highly mineralized.

Production from Atlas Consolidated Mining & Development Co.'s Toledo copper mine continued to decline last November. The company milled 332,000 tons but grade of mill heads slipped to 0,56% Cu, resulting in production of an estimated 3.051-million lb Cu and 667 oz Au. In addition to the copper concentrates, 3,750 tons of pyrite were shipped to the National Power Co.

Charles A. Mitke, president of the Manila Mining Co., declared that changes must be made in the Philippine mining laws to ease the development and operation of mineral resources in Mindinao, where the company has several good copper-gold deposits. According to Mitke, claim jumpers are a major problem and that the present laws offer little protection to legitimate operators.

Lepanto Consolidated reported that its milling rate was maintained at 1,100 tpd during November. Production exceeded 2.2-million lb Cu and 3,550 oz Au. Concentrates averaged 30% Cu and 0.9 oz Au. The average copper content of the crude ore was 3.27% and gold averaged 0.13 oz per ton. Unlike other Philippine copper mines.

Surigao Consolidated Mining Co., Inc. will very shortly resume exportation of zinc concentrates. During the years 1952 and 1953, the company exported 7,870 tons of zinc concentrates, containing a total of 8,330,298 lb of zinc. However, because of the metal's deteriorating world market price, exports were discontinued after 1953.

The major cause for the resumption of concentrate exports is the slight increase in the zinc world price. Added to this is the possibility of obtaining a barter license for exportation of concentrates. Surigao Consolidated has contracted for the sale of 15,000 tons of concentrates to Philipp Brothers Far East Inc., New York.

Surigao Consolidated reported that diamond drilling on its Zamboanga copper property has outlined three high grade veins at 300 ft, showing widths of 3 to 10 ft, and averaging 6% Cu. On the south end of the property a tunnel following the vein for over 200 ft has revealed an average of 6% Cu over 5 to 13-ft widths.

In an address before the Manila section of the AIME, mines director Benjamin Gozon declared that geological exploration and development on the islands of Nonoc, Awason, Hanigad, southern Dinagat, representing a parcel that the Government is offering for sale, contains a positive reserve of 157-million tons averaging 1% nickel, 46% iron, and 0.08% cobalt. This estimate does not include reserves on the Surigao mainland and the island of Dinagat. The new nickel law assures investors of reduction of the Government's share to not less than 35 of net annual profit of 3½% of gross annual recipts along with exemption from all taxes until 75% of the invested capital is recovered, and repatriation of 80% of foreign capital investment and remittance of profits and dividends to foreign investors from the first year of production.

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Superintendent—Mining or Construction. Age 39, E.M. degree 1947. Experience underground mining, surface plant construction, shaft sinking. Registered P.E. (Utah). Resume on request. PW-3291, Engineering & Mining Journal.

Consulting Mining Engineer-Geologist desires to manage or contract-mine small equipped operation; also, exploration and valuation reporting for investment groups; metallics, nonmetallics, petroleum; experienced in all; graduate. PW-3521, Engineering & Mining Journal.

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Geologist-Engineer thoroughly experienced all facets exploration and development both foreign and domestic. PW-3310, Engineering & Mining Journal.

(*Continued on following page*)

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Metallurgist—30 years old, 7 years experience in all phases of copper concentrating and smelting in North and South America. Desires position in developmental research. Married. Foreign preferred. PW-3414, Engineering & Mining Journal.

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Euclid 49 FD 8984	Water Wagon	(1)	1947
Euclid 49 FD 7761	15 tons	(3)	1948
Euclid 49 FD 8179	15 tons	(3)	1948
Euclid 49 FD 10178	15 tons	(3)	1951
Euclid 49 FD 10179	15 tons	(3)	1951
Euclid 49 FD 10180	15 tons	(3)	1951
Euclid 49 FD 6753	15 tons	(1)	1947
Euclid 49 FD 7471	15 tons	(1)	1948
Euclid 63 TDA 21201	22½ tons	(4)	1957
Euclid 63 TDA 21709	22½ tons	(4)	1957
Euclid 63 TDA 21216	22½ tons	(4)	1957
Euclid 63 TDA 21708	22½ tons	(4)	1957
Euclid 49 FD 10108	15 tons	(1)	1951
Euclid 49 FD 7245	15 tons	(1)	1948
Euclid 49 FD 7239	15 tons	(1)	1948
Euclid 23 FDT 4347	33 yd. Coal Hauler	(1)	1945
Euclid 23 FDT 4387	33 yd. Coal Hauler	(1)	1945
Euclid 46 TD 21544	22½ tons	(5)	1957
Euclid 46 TD 21545	22½ tons	(5)	1957
Euclid 46 TD 21303	22½ tons	(5)	1957
Euclid 20 TD 10583	22½ tons	(6)	1950
Euclid 20 TD 10591	22½ tons	(6)	1950
Euclid 20 TD 10830	22½ tons	(6)	1950
Euclid 20 TD 10837	22½ tons	(6)	1950
Euclid 20 TD 10581	22½ tons	(6)	1950
Euclid 32 TD 11475	22½ tons	(6)	1951
Euclid 20 TD 10582	22½ tons	(7)	1950
Euclid 20 TD 10836	22½ tons	(7)	1950
Euclid 20 TD 10588	22½ tons	(7)	1950
Euclid 20 TD 10835	22½ tons	(7)	1950
Dart 10 SUG 57037	10 ton Underground	(5)	1957
Dart 10 SUG 57038	10 ton Underground	(5)	1957
Dart 10 SUG 57051	10 ton Underground	(5)	1957
Dart 10 SUG 57052	10 ton Underground	(5)	1957

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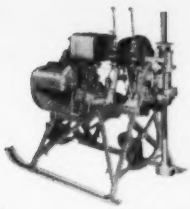
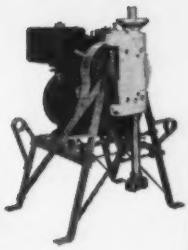


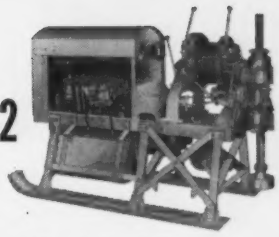
BBS-1

World's best known surface drill. Handles "E" Rods to 1,500 ft., "A" to 1,100 ft.



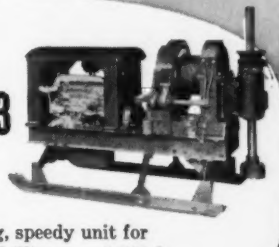
X-ray

Compact, portable—185 lbs. net. Takes ¾" or ⅞" core to 200 ft. Low fuel consumption.



BBS-2

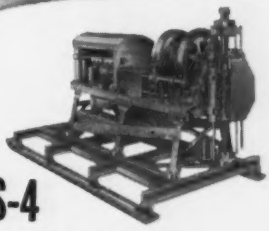
Versatile, choice of 5 swivelheads. Depths to 3,500 ft. Gas or diesel.



BBS-3

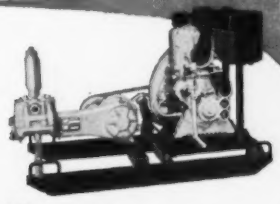
Strong, speedy unit for deep drilling . . . 4,600 ft. with "A" or "B" Rods, 95 h.p. diesel.

if it's for diamond drilling we make it!



BBS-4

Drills to 5,000 ft. with "B" Rods. Moves under own power, gas or diesel.



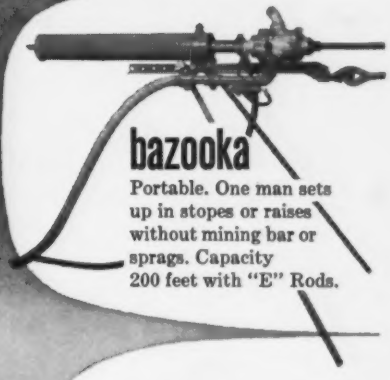
drill pumps

5-12 and 4-7 models. Capacities 400 to 1,200 g.p.h. Diesel motor optional.

permaset bits

(Powdered metal)

All standard sizes available from stock. Also reaming shells, etc.



bazooka

Portable. One man sets up in stopes or raises without mining bar or sprags. Capacity 200 feet with "E" Rods.

JV

4 feed swivelhead. Capacity 800 ft. with "E" Rods. JVR with right-hand feed screw for blastholes.

BBU-2

Rugged. Capacity 1,800 ft. with "E" Rods, 1,400 ft. with "A", four gear speeds.

VEG

Vane motored version of J.V. Lightweight, compact construction. Can be speedily dismantled into two units.

58-5

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CAT CATERPILLAR

Parts you can trust
...cost less per hour

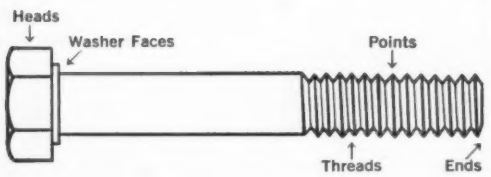
CAT ALL-PURPOSE BOLTS AND NUTS ARE STRONGER... HOLD LONGER...GRIP BETTER

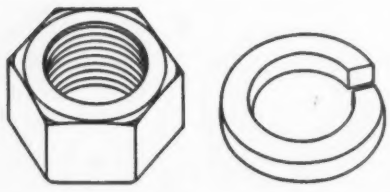
Ever twist a head off a bolt because it wasn't *strong* enough . . . or scrape your knuckle when your wrench "rounded off" the head because it wasn't *hard* enough? It's not likely to happen if you use Cat all-purpose bolts and nuts. They're highest quality in every way. For example, Cat bolts exceed Grade 6 in all requirements as rated by the Society of Automotive Engineers. Grade 5 is the average rating of bolts used in other earthmoving equipment.

WHAT GRADE OF BOLTS DO YOU USE?

Here's what's normally stocked at . . .	Hardware Stores, Automotive Outlets	Industrial Supply Houses, Other Mfr. Outlets	Special Order Only	Caterpillar Dealers
SAE	Grade 0-3	Grade 5	Grade 6	Exceeds Grade 6
Minimum Tensile Strength (Breaking point)	55,000-110,000 PSI	105,000-120,000 PSI	133,000-140,000 PSI	142,000 PSI
Hardness Rockwell Rating	RC 0-28	RC 19-32	RC 28-36	RC 30-38

If you need tougher, stronger hardware—get Cat all-purpose bolts and nuts. You can count on them to do a better job longer because they're stronger and harder than others.





HERE ARE OTHER CAT BOLT BONUSES YOU GET. *Heads* are higher and full size—easy to get wrenches on. *Flats* are hard and parallel—corners don't round off, are easy to grip. *Threads* are rounded at the roots and free from laps and burrs. *Points* are smooth and uniform. *Ends* are precisely rounded or chamfered—cross-threading doesn't occur. *Washer faces* are flat and have uniform thicknesses. *Heads and threads* are concentric to shaft—heads and nuts fit flush.

NUTS AND LOCK WASHERS are matched to every size bolt to give complete top-quality fasteners, too. Nut threads resist stripping. Corners do not round. Clean, smooth-fitting threads make installation fast and easy. Lock washers have smooth surfaces for maximum wear and strength.

When you need the best bolts and nuts to keep your machinery and other equipment together, see your Caterpillar Dealer. He has a large selection.

Caterpillar Tractor Co., General Offices, Peoria, Ill., U.S.A.

SERVICE TIP: Get your free copy of Caterpillar's bolts and nuts reference booklet at your Caterpillar Dealer today. It has the sizes, threads and part numbers listed for quick, easy ordering. Before buying any hardware, check Cat prices first.

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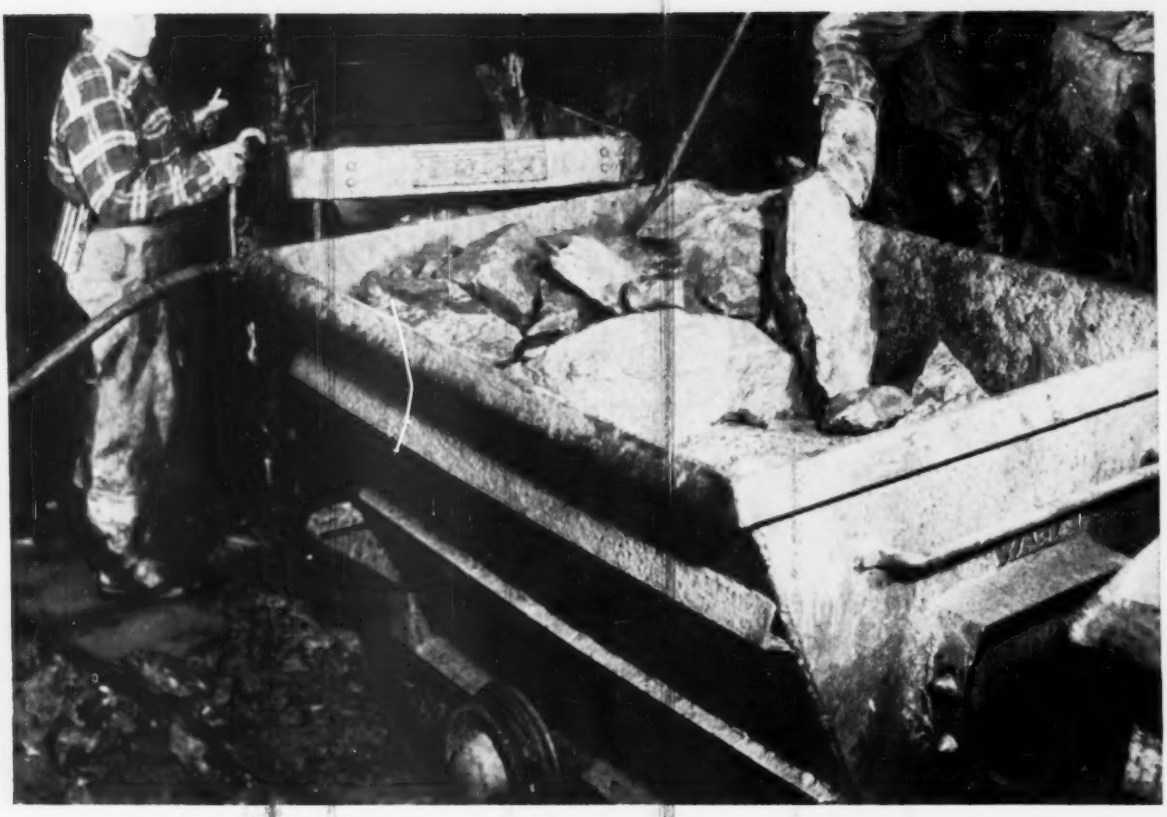

WABI reports: "Cars take sharp underground curves ...TIMKEN® bearings take the thrust, cut maintenance costs"

SHARP curves on this underground railroad put heavy thrust loads on the mine car wheels. To take the thrust, keep the 2,300 lb. cars hauling their two-ton loads steadily with minimum maintenance, Wabi Iron Works Ltd. mounts the wheels on Timken® tapered roller bearings. (See diagram right.) Timken bearings *roll* the load . . . assure users of Wabi mine cars longer bearing life and trouble-free operation. Here's why:

1) *The tapered design* of Timken bearings lets them carry both radial and thrust loads, or any combination.

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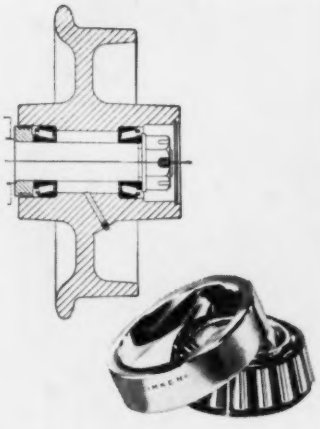
3) *The bearing's heart*—the steel—is the finest bearing-quality alloy steel available.

4) *Holding shafts concentric* with their housings, Timken bearings make closures more effective—keep dirt out, lubricant in.

To make the machines you build or buy better, equip them with Timken tapered roller bearings. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO". *Makers of Tapered Roller Bearings, Fine Alloy Steel and Removable Rock Bits.*



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